# Electrical World

The Consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.

VOL. XLVII. NEW YORK, SATURDAY, MAY 5, 1906. No. 18.

PUBLISHED WEEKLY BY THE

## McGraw Publishing Company

114 LIBERTY STREET, NEW YORK.

TELEPHONE CALL: 7605 CORTLANDT. CABLE ADDRESS: ELECTRICAL, NEW YORK.

EDITED BY T. C. MARTIN AND W. D. WEAVER.

CHICAGO OFFICE.....1139 Monadnock Block
PHILADELPHIA OFFICE.....Real Estate Trust Building
CLEVELAND OFFICE.....405 Cuyahoga Building
EUROPEAN OFFICE.....Hastings House, Norfolk St., Strand, London, Eng.

### TERMS OF SUBSCRIPTION

United States, Canada, Cuba and Mexico.....Per year, $3.00
Foreign Countries, within the Postal Union.....$6.00
Great Britain and Ireland.....25 shillings
Germany.....25 marks
France.....31 francs
Single copy.....10 cents

Remittances for foreign subscriptions may be made through our European office. Requests for changes of address should be made one week in advance, giving *old* as well as new address. No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.



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Entered as second-class matter at the post office at New York, N. Y., under the Act of Congress of March 3, 1879.



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Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday for the paper dated Saturday of the same week.



*Of this issue of the* ELECTRICAL WORLD *27,000 copies are printed. Total circulation for 1906 to date, 350,500, an average of 19,472 per week.*


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## THE METRIC SYSTEM.

The secretary of the American Institute of Electrical Engineers issued, during the first week in April, a circular letter to the membership, asking for the return by mail of a coupon vote either for or against resolutions of the Institute's Standardization Committee. The gist of those resolutions is contained in the last clause, namely, that the Institute Standardization Committee "favors such legislation by Congress as shall secure the adoption of the metric system by each department of the National Government as speedily as may be consistent with the public welfare." We are informed that 1,635 votes have been returned from the membership in answer to the circular letter. Of these, 1,474, or 90.15 per cent, were for the metric system resolutions, and 161, or 9.85 per cent, were against. It thus appears that there is an overwhelmingly large sentiment among electrical engineers in favor of some legislative action which shall pave the way for the ultimate general adoption of the metric system on the North American continent. We certainly think that Congress should recognize this strongly expressed sentiment, and that to ignore it would be a positive injustice not only to international comity, civilization interests and common sense, but also to the engineering and electrical manufacturing interests of its citizens.

There is a bill in the House of Representatives named the Littauer bill, entrusted to the House Committee on Coinage, Weights and Measures. That bill provides that after June, 1908, all departments of the United States Government shall employ the metric system in conducting their business. It is well known that a number of the Government departments already use the metric system in their business, and that others would only be happy to be permitted to do so. Consequently, the bill merely provides for uniformity in Government action, and would stop the existing duality and unnecessary expense of carrying on two systems of bookkeeping side by side. The only opposition of any consequence comes from a certain section of manufacturers, the great body of manufacturers being divided upon this question. The conservative element fears that if we have a Government that reckons in metric units the Government will insist upon every part of a machine or a commodity being to exact millimetre size. It believes that Uncle Sam, if he measures with a metre-stick inside of a yard-stick, will become a veritable Shylock, and insist on his exact kilo of flesh. But Uncle Sam if he were as unreasonable as that might be just as oppressive now without any metric system club. He could insist on buying only such clocks, for instance, as had mainsprings exactly three-eighths of one inch wide, with a tolerance of no more than one-thousandths of an inch, broader or narrower. When Uncle Sam buys an article, however, he displays the same reasonable desire to get the finished product in satisfactory working order as do ordinary mortals.

There is not the least ground for supposing that under the metric system of measurement things made by the foot-rule would be discriminated against, or standard gauges, tools or sizes depreciated. Witness the fact that many American manufacturers now sell tools and commodities abroad to metric-using countries,

without any difficulty, although these tools were made by the use of the inch or foot-rule. No man living in a house built by the foot-rule is made discontented with his abode because he adopts the metric system and measures things with a metre-stick. The English-speaking peoples always have been slow to adopt a good thing. Venice had the present Arabic system of notation for many decades before England changed from Roman numerals in keeping accounts. All continental Europe save Greece, Russia and remnants, adopted the present Gregorian Calendar in 1582, while England stuck to the old Julian Calendar until 1752, when she joined the procession by skipping eleven days. The English-speaking peoples are still driving the lumbering old family coach of barbaric weights and measures, to the laughter of Continental Europe, and to the joy of our commercial rivals. Out of self-respect, let us reform.

## Standard Underground Cable Practice.

Two papers on standard practice in underground cables for light and power distribution were read at the last meeting of the American Institute of Electrical Engineers. They indicate jointly how much room for improvement exists in the development of insulated wires and cables in regard to economy of first cost combined with a large factor of safety at high pressures. The first paper, a very practical one, by Mr. John Langan, on "Standardizing Rubber-Covered Wires and Cables," takes the general position that there is nothing like rubber, and that when you have Para rubber, there is nothing like thirty per cent of it. The creed might be formulated thereon, that there is but one insulator, which is rubber, and that its proportion is thirty per cent. Therefore, we should draw all specifications for cables in such a manner as to make sure that in their dielectric composition there exists 30 per cent of pure Para and let the remaining 70 per cent look after itself.

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It is quite true that many of our best cables have about 30 per cent of Para rubber in them, but the subject is far too broad to be delimited in this way. Pressures of long-distance distribution are steadily rising. It is now standard practice to operate overhead lines at 60 kilovolts, to test special forms of apparatus at 200 kilovolts, and to operate underground lines at 11 kilovolts. Certain portions of underground cable in the United States are operating at 20 kilovolts. The industry is restricted to some extent to-day by reason of the expense of insulating cables for high pressures. Rubber is by no means the only good insulator to employ. It withstands a stress of from 20 to 40 kilovolts per millimetre; but it is one of the very few elastic or non-rigid insulators. It is also obtained by electric cables, in competition with automobiles, at a constantly increasing cost, and in a constantly decreasing degree of purity, from the tribes that inhabit tropical forests.

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It is doubtful if there could be a more valuable industrial discovery at this time than an insulating substance of large dielectric strength, durability, pliability and low cost. The search for such a material among compositions is wide open. In the case of a search for conductors like copper there appears to be a law of Nature limiting the requirements to pure metals, so that the field is quickly exhausted; but as to insulators enclosed in a metal sheathing, like paper, varnished cambric and the like, there appears to be no such limitation, and either a compound or a mixture of substances might at any time be found capable of meeting the demand. Practice seems tending to demand a factor of safety of at least three, in the purchase of high-tension cables, as far as working pressures of 12 kilovolts at least. Much experimental investigation and practical experience will have to be accumulated, however, before the underground cable can be fully standardized.

## A Recent Lighting Rival.

Central station men have perhaps noted the recent attempts to produce a Welsbach burner capable of working upside down so as to give unobstructed light below it. With the ordinary Welsbach they are already only too familiar, and the effect of the new arrangement will be watched with keen interest. So far as we have seen the upside-down burners they have been only very moderately successful. The trouble seems to be that unless the gas is under more pressure than is generally permitted there is a tendency to smoke that greatly diminishes the usefulness of the light, while the heat damages the finish of the fixtures. These are practical objections that may or may not be overcome, but beyond them lie others even more difficult to avoid. The color of the mantle burner is not changed by inversion, and so long as it remains of the prevalent hue it will be unpopular in many fields. It is doubtful indeed whether the color can be materially changed without affecting the efficiency injuriously, since that efficiency is largely due to the very selective radiation that causes the greenish light. More than this, it is difficult to see how inverting the mantle really is of much service to the distribution of light, since the taper of the mantle is slight and the downward illumination rather weak in either form unless a reflector be used, in which case the results would be substantially alike.

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The fact is that a great deal too much has been made of the natural distribution from flames and glow lamps. The latter are generally and advantageously placed with axes inclined considerably from a vertical, and if any particular distribution of light is wanted it is much more effectively obtained by a reflector than by changing the form or axial position of the lamp itself. The same fact holds good for gas lamps of all kinds, and granting that downward illumination is wanted for some particular purpose, the ordinary Welsbachs can and do obtain it efficiently by reflectors; and that is substantially all that the inverted Welsbachs are capable of. On the whole we cannot see that this new form of an old lamp is any more of a menace to the central station man than was and is the old one. The only real menace is the extreme cheapness of light from the mantle burners, but until the color thereof is remedied its quality will stand against their use. With arcs, Nernst lamps, Hewitt's and metallic or graphitized filament lamps, the central station man will be in a pretty good position to make a winning fight against the Welsbach in all its forms when he gets ready to do so. The electric arc can make a good fight against the "gas arc," particularly if the flaming arc gets down to a broad commercial basis, and the others mentioned can carry the conflict into smaller units. So long as the central stations discourage the small consumer he will very naturally take to Welsbachs, but when they get really ready to carry the war into Africa the munitions are ready at hand. The flaming arc is actually the cheapest known illuminant for work on a large scale, beating out even the gas arc under its most favorable conditions, and the new crop of incandescents

can push the Welsbach hard even in price. When central stations get out after the cheap lighting business it will be theirs if they keep up with the times.

## COMBINATION POLE LINES.

There is rightly a constantly increasing tendency for electric light, railway and telephone companies covering the same territory to consolidate pole lines in the outlying districts wherever possible, thereby saving the expense of separate sets of pole lines as well as improving the general appearance of the streets. The necessity of keeping electric light and telephone wires well apart on combination pole lines, of course makes advisable the use of longer poles than would usually be needed if the two lines were separate. Where two companies occupy the same poles the question always comes up as to the proper location of the various wires. Sometimes this is worked out on common sense engineering lines and sometimes it is a result of an arbitrary decision by the management of one of the companies owning the lines, this decision being virtually backed up with the convincing argument "Do things our way or not at all." Sound engineering practice usually places the heavy wires on the top cross arms and the small telephone or signal wires on the lower cross arms. There are two good and sufficient reasons for this. The small telephone and signal wires are more likely to break than the lighting and power wires. Furthermore, there are usually more of them on a pole than there are lighting and power wires. The chances are, therefore, much greater that telephone wires if placed on the top cross arms will fall among the light and power wires than that the light and power wires will fall upon the telephone wires. With telephone wires on the lower cross arms they simply fall on the ground. The other good reason for placing the light and power wires on the top cross arms is that the telephone lines are worked on by linemen much more than light and power wires, and they are less dangerous for a lineman to pass through. With the light and power wires on the lower cross arms, telephone linemen must pass through them every time work is done on the telephone lines. They are not only in constant danger from passing through these lines so frequently, but there is always a chance that in stringing new lines they will get a cross between the wire that is being strung and the electric light wire. Taken all together, it would seem that no worse arrangement could be proposed than that of placing telephone wires on the top cross arms when it can be avoided; yet this is being done in some places under the method of arriving at decisions before mentioned.

## VOLTAGE REGULATION.

It should hardly be necessary to call attention at this late day to the importance of good voltage regulation to central station service. Next after reliability of service, good voltage regulation is most essential in giving customers satisfaction. Without it low-efficiency lamps must be used. With it high-efficiency lamps are feasible which will reduce the cost of supplying light more than anything except radical changes in generating apparatus. In spite of these facts, which have been dwelt upon for years, there are scores of central station systems on which the voltage regulation is very bad. As a rule, there is no excuse for such bad conditions. If a central station company will figure up what poor voltage regulation costs it in the shape of lamps burning below good efficiency on one hand and excessive lamp renewals due to over-voltage on the other, it will usually find that the loss will fully justify the cost of the necessary changes to secure good regulation.

These changes may consist in the purchase of automatic voltage regulators to be placed on the generators; the purchase of additional feeder copper; the securing of better switchboard attendance, or the combination of these remedies. There is now less excuse than there used to be for poor voltage regulation at station bus-bars because of the presence on the market of automatic voltage regulators which will maintain a steady voltage under exceedingly trying conditions of mixed fluctuating power and lighting load. It is certainly short-sighted for a company having poor voltage regulation and not furnishing free lamp renewals, to argue that since lamp renewals cost the company nothing, good voltage regulation is of secondary importance. If the voltage is above normal part of the time, the customer objects to the poor service when it is not above normal, without considering that the high voltage causes excessive lamp renewals. On the other hand, if the voltage is below normal, the customer is not being given the results he should get for his money, to say nothing of his objections to a dim light.

## CONCERNING ELECTRIC HEATING.

In these days when central stations are actively looking for new business, it strikes us that a little more attention to the uses of electricity for heating would pay well. Plants here and there have been devoting some attention to the subject for a few years past, especially in connection with flat-irons, but it has not been pursued with much vigor save in a few instances. There has been much hesitation in favoring a use for energy in which full lighting rates are evidently out of place, even when rates in themselves profitable can be obtained. There are at present available all sorts of heating appliances at reasonable prices and of good quality which would give the central stations good revenue if their use were encouraged, and the load is one which in itself has usually proved to be desirable in that it tends to level up the hollows in the load curve. Moreover, it is a use that when once made economically possible will persist, while some other popular uses will not. For example, the very extensive use of electric signs now evident is one that may feel severely the first incursion of hard times, as representing a fashion rather than a daily necessity of commerce. Once get electric appliances into the household, shop or factory, however, and they will stay so long as they give good and reasonably economical service. On the other hand, appliances the practical value of which is not immediately evident, are easily displaced.

The policy of the gas companies has been very far-sighted in this respect. Instead of making rates to penalize the small consumer, they have favored him, perhaps even unduly. They have made it possible by persistent and liberal exploitation, for the small consumer to be introduced on an economic basis to all manner of gas-heating appliances, and they are getting ready to raid the motor business with small gas engines in a way that may before long be felt. The moral effect of this policy is at once felt through the community. A householder who finds that a gas range is cheaper than a coal range, and that a gas log is not to be despised as an occasional auxiliary heater, will gen-

erally not think it worth his while to run an additional bill for electric lights; and he is an easily made friend of the gas engine. And that is the policy that we expect of our central station friends—to develop every field, old and new, that promises ultimate profits, and to occupy it so fully that the other fellow cannot get a foothold. The electric heating appliance business at the prices of energy ordinarily met, cannot at present be a very large item, but in certain plants it can be made thoroughly profitable as a source of additional load. Once show a man that electric cooking apparatus and the like is wonderfully handy and reasonably cheap, and he will keep it in use and add to the station's revenue year after year. In summer and in the warmer parts of our country, this line of work can be followed up with good results, especially when the station uses hydraulic power. Some of the Southern California plants have built up quite a large business in this way, selling energy at 3 to 4 cents per kw-hour and competing very successfully with gas at, say, $1.50 per thousand cubic feet.

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Attempts at ordinary air heating by electricity have not been satisfactory at a similar price, nor is it to be expected. On the other hand, gas for this purpose fails in similar fashion, save as an occasional auxiliary. Gas heat as ordinarily used is extremely bad from the hygienic standpoint. It vitiates the air very seriously indeed, and the moisture produced by the combustion makes itself a nuisance unless there is very thorough ventilation. Of course, there are places where coal is high enough in price to give electric heating a chance. It has even now been found that electric radiators can be made useful in bathrooms, bedrooms and the like, at a cost that is not prohibitive. With energy down to 2 or 3 cents per kw-hour, and especially when its use for this sort of work can be kept off the peak of the load, there is chance for a growing business. Of course, it is clear that there are many plants which could not profitably meet such a price. On the other hand, there are many which can and do make such quotations even for load carried over the peak. The miscellaneous thermal uses of electricity can be carried at better prices, air heating representing the least general and most unfavorable case. We know of plenty of hydraulic plants where a thousand kw-hours per day of off-the-peak load would not be looked at with contempt even at 3 cents per unit. It should be noted, too, that this kind of load, being mainly off the peak, does not bear heavily on the capacity of transformers or of the distribution system. At the price mentioned, electric kitchen equipment is not outclassed in economy by either coal or gas. Experience has shown that 3-cent energy is about on a par with dollar gas in cooking apparatus, and it is reasonably certain that dollar gas is cheaper than anthracite at the cost now common away from the anthracite districts. Even with energy at 4 to 5 cents per unit, the electric cooking and miscellaneous heating is on a par with the use of coal at $6 to $7.50 per ton. Here is a field for exploitation worth serious effort. Granting for the present that heating on a large scale by electricity is too costly, there still remains a chance for putting in the auxiliary and miscellaneous heating appliances on a sound economic basis. The gas companies make no pretense of competing with coal for general house heating, but they derive large revenue from just the class of work here referred to, a revenue which is thoroughly available if the central station will really get after it in earnest.

## Isolated Plants as Non-Peak Load.

One possible relation of isolated plants to central station business which does not seem to have been given the attention deserved is that of supplying such plants with current during periods when, on account of the light load or the absence of steam heating they can only operate at very poor economy. As is well known, the operation of an isolated electric light or power plant is in many cases justified only by the fact that exhaust steam can be used for heating the building; during the summer the kw-hour cost becomes high unless it is very large or so situated that there is plenty of room in which to install economical types of apparatus. There are certain other plants, especially those driven by gas engines, whose operation 24 hours a day is an expensive proposition, although they can doubtless be operated on good economy during the evening peak load. Not a few isolated plants are operated by central station supply during periods when they cannot operate profitably themselves, and this is a matter which will bear looking into still further in places where central station men have taken it for granted that once an isolated plant is installed there is no further hope for doing business with the owner. As a matter of fact, he may become a very desirable customer, helping to increase the non-peak central station load. In such cases the customer carries the heavy readiness-to-serve investment which otherwise the central station would have to bear. While the kw-hour consumption may not be very great during the light load hours of an isolated installation, it is nevertheless a desirable class of business. When it comes to supplying an isolated plant with what is usually called a break-down service—that is, a service available for use at any hour in case of break-down—it is a very different proposition, as the central station must be prepared to take load at the peak at any time. Readiness-to-serve charges on isolated plants which are likely to be thrown on at any moment in this way, should justly be on a parity with the readiness-to-serve charges paid by any large customer.

## Rates for "Non-Peak" Load.

We are inclined to think that insufficient attention has been given by central station managers to the question of motor and other load which would not come on the peak during the months of November, December and January. The capacity of the majority of central stations operating under normal conditions must be determined by the demand for energy about 6 p. m. during these three months of the year. It has been the constant aim of the more progressive companies to flatten out this winter peak by various schemes for securing long-hour users for both lamps and motors. Nevertheless, the majority of the long-hour users are on during the winter peak as well as during the hours when the general demand for energy is low. Whenever it has been suggested in discussions of this matter at conventions and elsewhere that small industries using motors might be secured as customers at low rates with the express stipulation that power should not be used during the winter peak load hours, some one has invariably raised the objection that the central station must be prepared to deliver energy whenever it is demanded, and that attempts to regulate the hours when the customer will use it are failures.

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The objection has also been raised that such a contract is difficult to enforce because theoretically it takes a patrolman to

determine whether special contract customers are using power during the winter peak hours, and second because even if they are using the power in violation of their contract during such hours they are likely to object strenuously to shutting down if they happen to be in need of power, during the prohibited time. While these arguments sound plausible and have much of truth in them the fact remains that the plan of taking certain customers at low rate contracts which expressly stimulate that power shall not be used during the winter peak load hours is being very successfully put in practice in a number of cities. The most notable example is Montreal, Canada, where numerous factories in consideration of low rates for electric energy shut down during the winter before the domestic lighting load comes on. We recently printed an account of the plan put into effect at Rockford, Ill., for automobile charging at a rate considerably below the regular lighting rate with the express stipulation in the contract that charging is not to be done during certain hours which correspond to the winter peak load period.

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Several years ago we mentioned the low rate contracts made at Red Oak, Iowa, for the operation of refrigerating machine motors, which the central station company has the option of cutting off during its peak load hours if it desires. Most of the central station companies with contracts for city water pumping have taken these at a figure much lower than they could afford if it were not that they have control of the hours of pumping, so that they do not come on during the lighting peak. We have in mind another enterprising central station company in a town of 20,000 inhabitants operating a very economical electric and hot water plant, which maintains a load factor on week days of 55 per cent for 24 hours. The economy of production in this case is in no small degree due to the high load factor maintained through a large number of factories taking power under contracts which expressly stipulate that at the company's request power shall not be used during certain hours, these hours being closely calculated so that the factory power users shall not come on at the top of the winter peak, and at the same time shall not be seriously inconvenienced by being obliged to shut down during these hours. Many of these factories operate day and night shifts. It is a simple matter for them to arrange their shut-down period to cover the central station company's winter peak hours. Central station managers have been too much inclined to accept without question the assertion that manufacturing companies cannot be induced to change their working hours to accommodate the central station. The ordinary factory hours do not greatly overlap the winter peak load hours and in many cases it is an easy matter to change them. When there is offered the inducement of cheap power in consideration of shutting down during this short period every day for three months of the year a factory manager is more than likely to consider the proposition seriously, as the example of Montreal demonstrates. Even where a factory is running overtime—that is, when the regular force is working days and also a few hours each evening—it is an easy matter to make the supper hour from 5 to 6.15 rather than from 6 to 7.

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In many cases it is not necessary to insist upon the non-peak clause in such a contract, as the central station ordinarily has (or should have) reserve capacity over and above its maximum winter peak load. There is no reason why this reserve should not be operated to carry customers on non-peak contracts who may be especially desirous of operating during peak hours; and if for any reason the central station is obliged to call on its reserve capacity for its regular lamp and motor load, the non-peak customers can be notified by telephone and the situation at once relieved without difficulty. Wherever, however, a large number of non-peak contracts are entered into a manager cannot impress too strongly on a customer's mind that his is a non-peak contract; and the ordinary use of power during peak load periods by non-peak customers should be discouraged even though he may have the reserve capacity to serve them most of the time. If these non-peak customers once get in the habit of using power during the peak, they are apt to consider it a hardship if they are occasionally asked to shut down; whereas, if they are ordinarily shut down during the peak anyway, it is accepted as a matter of course as a part of the low rate contract.

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The unusually low rates which are made to non-peak users are, of course, based on the fact that many of the fixed and running charges in a central station are supposed to be taken care of by the ordinary rates for electric service which is likely to come on at the peak, and that the non-peak customer is entitled to use energy at a little above the operating cost of production without figuring much for interest and depreciation on the plant and distribution system. The practical effect of non-peak contracts is to give the central station double use of a part of its capacity. The equitable rate for this non-peak business would seem to be one which would charge the non-peak customer with some of the interest and depreciation on the plant, leaving the balance of these fixed costs to be borne by the peak user in the usual way. As a matter of fact, where non-peak users are factories employing motors a large number of hours per day, the fixed charges become such a small percentage of the total cost to the customer that the adjustment of this point is not one of very great importance in most cases. In the case of smaller intermittent non-peak users it cuts much more figure.

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The greatest difficulty about making non-peak rates to small consumers lies in enforcing the contract. There is no check upon the small intermittent user, and the company cannot afford to watch what is going on as in the case of the large power user. To insure keeping such small users off the winter peak would necessitate a patrolman or a rather expensive electrically-operated switch with a reliable clock for opening and closing the circuit at each customer's premises. Should there be any difficulty about enforcing non-peak contracts by larger power users, such an appliance for cutting in and out would be feasible. This whole subject of non-peak contracts is worth more attention than it has been receiving, for upon it depends the securing or the losing of important long-hour business, which, however, can be obtained only at very low rates which will compete with isolated plants. It is perfectly evident that a central station company with economical generating apparatus should be able to sell energy at a small profit to factories having small plants of their own. The load factor on these isolated plants may be excellent and the cost of production low, but the central station company should be able to beat the isolated plant's figure and make a profit. The central station can afford to make a better figure for non-peak load than for load which comes on the peak, and therefore should stand a better chance of securing this class of business at a profit on a non-peak contract than on an ordinary contract.

## A. I. E. E. Election.

The following communication from Dr. Louis Bell was received too late for classification under "Letters to the Editors":

I note with regret the acrimony that seems to have been aroused in the matter of the A. I. E. E. election. I do not desire to raise the question of fitness between two gentlemen for both of whom I have high regard, but the turn which the controversy has taken should certainly evoke a protest from the members who reside outside the immediate neighborhood of New York City. The American Institute of Electrical Engineers is supposed to be a national and not a local organization, and if preferment is to be based upon activity in the New York meetings it is high time either to change the Constitution accordingly or to make some drastic reforms in the workings of the central organization. The wishes of the members at large were indicated by the nomination papers and apparently showed in spite of a rather scandalous attempt at electioneering, that Mr. Rice was desired for president, and Dr. Sheldon for vice-president. Why the directors in making up their official ticket should have disregarded this I am at a loss to understand, for their action was needless, there being full provision for election of candidates not on this ticket, if the voting membership so desires. If this action is to be taken as a deliberate attempt to influence voters by giving them the choice of voting Dr. Sheldon into the presidency or ignoring him altogether then the sooner the directors drop this kind of ward politics the better it will be for the Institute. The whole proceeding strikes me as derogatory to the dignity of what ought to be a representative national body.

As to activity in the New York section as a prerequisite for office, the less said the better. Active workers have always been appreciated in the Institute, but it should be remembered that some of our most honored members have been too busy professionally, and too retiring personally, to be voluminous contributors to the proceedings. The Institute would have made itself a subject of international merriment had it turned down Mr. Edison as president on the ground that he has not been active in its debates. The Institute has indeed departed far from its early ideals if it allows itself to appear before the public as a local mutual admiration society swapping dignities among its ward workers. It is time to check the growing tendency toward denationalization. Personally I think it would be an excellent thing to so revise the Constitution and By-Laws that the official monthly meetings of the Institute should be held in rotation at the various large centers where the members are organized, reserving for New York in addition the titular headquarters and the annual meeting. The present relations between the Institute and its branches are farcical, and unless they are improved the inevitable result will be disintegration, which as an old member keenly mindful of the hard united work of the earlier days I should profoundly regret. Distances in our country are too great to permit the long continuance of narrowly centralized administration in a general society and steps should at once be taken to get upon a broader basis. It is the short-sighted attitude displayed in the present election which I regret more even than the existence of an irregular and unfortunate contest. I write this in the hope that the great unobtrusive majority of my fellow-members may be aroused to rebuke petty politics to waken the directors to a keener sense of democratic ideals, and to work for the nationalization of the Institute lest it shall enter evil days of strife and lose the prestige which it has honestly earned.

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The following letter has also been received from Mr. Herbert A. Wagner:

A short time ago I was requested to subscribe to a circular sent to the members of the A. I. E. E. urging that votes be cast for Dr. Sheldon for president. The letters from Mr. Mershon and Mr. Rice, published in your issue of April 21, and from Mr. Mailloux, published in your issue of April 28, impel me to write a word of explanation. My action in subscribing to the said circular was based upon the feeling that the prominent engineers of the large manufacturing companies had been honored with the presidency of the Institute with a frequency, which if continued, might result in the ignoring of many other prominent and eminently qualified members of the Institute, who by their work, both in and outside of the Institute, are highly deserving of the honor.

I had no desire, however, to draw any comparison between the qualifications of the two present candidates, both of whom I hold in high regard, and who, I think, have equally the welfare of the Institute at heart. I do not agree with Mr. Mershon and Mr. Mailloux that work in and for the Institute should be regarded as the strongest qualification for the office of president. On the contrary, I am fully in accord with the point of view taken in your editorial comments.

It is to be deplored that any reference should have been made in the published letters to the alleged employment of commercial organization and methods to obtain votes for Mr. Rice, and I think Mr. Rice's reply thereto should commend him to every member of the Institute.

## Rubber Covered Cables.

At the regular monthly meeting of the American Institute of Electrical Engineers, held April 27, two papers were read on the general subject of high-tension underground cables. A paper by Mr. John Langan dealt with the standardizing of rubber-covered wires and cables, while a paper by Mr. Wallace S. Clark consisted of comments on present practice in underground cable work.

A considerable portion of Mr. Langan's paper was devoted to a discussion of the defects which develop in cables when the insulation has not been properly prepared and applied. Nothing could be more misleading than the general belief that a potential test is, in itself, a criterion of permanent value. Many obviously cheap insulating compounds will withstand very high potential tests, and yet will, in a short time, break down in actual service. Compounds containing certain oils may possess good insulating qualities initially, but when the oils evaporate the compounds disintegrate and decay. The consensus of opinion is that rubber is the best of all insulating materials. Rubber in itself, however, is valueless as an insulating medium. The mysterious factor which gives to rubber its durability and immunity from oxidation when exposed to atmospheric and other conditions is the process of vulcanization, which consists in adding about three per cent of sulphur to the rubber and then subjecting this association to a certain temperature for a certain duration of time. It has been found that the life of rubber bears a direct relationship to the resinous matter it contains; the best grade of rubber seldom has more than one per cent, while in the cheaper grades there may be from five to twenty per cent. It is possible, therefore, to determine the grade of the rubber by ascertaining chemically the amount of resinous matter.

The author suggests that all conductors should have at least 98 per cent conductivity and should be thoroughly and evenly tinned. The insulating compound should contain not less than 30 per cent and not more than 32 per cent of fine Para rubber. No shoddy, reclaimed rubber, rubber substitutes, or the like, must, in any form, be in the compound, the extractive resinous matter of which, when chemically analyzed, must not exceed 5 per cent. All wires and cables properly insulated in accordance with the above provisions should, after a 48-hour immersion in water, at a temperature of 60° F. and before tape, braid, or lead is applied, show the following insulation resistance and voltage tests. A 600-volt cable should withstand a test e.m.f. of 1,000 volts for one minute, and should possess an insulation resistance of from 500 to 1,000 megohms per mile. A 3,500-volt cable should withstand 5,000 volts for one minute, and should show a resistance of from 600 to 3,000 megohms per mile, depending upon the size of the cable. A 5,000-volt cable should withstand 10,000 volts and have a resistance of from 1,000 to 2,500 megohms per mile, while a 11,000-volt cable should withstand 15,000 volts and show a resistance of from 1,500 to 4,000 megohms per mile. For railway signaling, fire alarm, telephone and telegraph purposes the insulation resistance per mile should vary from 2,000 megohms for a 4-0 conductor, to 3,000 megohms for a No. 18 wire, while

the voltage which the insulation will withstand should vary from 2,000 for the former to 1,000 for the latter.

In addition to the above tests, the insulating material of every wire should withstand an elongation test of stretching three times its length several times; that is, a piece 2 in. long must stretch to 6 in. and promptly return to within 20 per cent of its original length. It must then stretch four times without break or rupture and return to 25 per cent of its original length. This elongation test is intended principally for Code wire, and would, even by omitting all conditions as to rubber, compel results that would be entirely reliable and satisfactory for all conditions of Code use.

Any piece of insulation, about ½ in. wide by 1/16 in. thick, stripped from the completed wire or cable, should withstand a tensile strain of 800 lb. to the square inch, and stretch to 3½ times its length without rupture.

The paper by Mr. Clark reviewed some of the practices in underground cable work for lamp and motor service which have now become almost standard in America. In discussing the lead covering on cables, attention was drawn to the fact that the continuous sheath on a cable, which is used as one side of a grounded circuit, is an invitation to stray currents and to electrolysis. It has sometimes been found that the ground of the sheath instead of being a cure for electrolysis is a cause of trouble. A proper cure would be obtained by omitting the sheath. Abandoning the lead entirely, however, is an economic possibility with only very large conductors. Where it is necessary to use a lead sheath, the best results will be obtained when the sheath is interrupted by some form of insulating joint on low-tension cables. In this case the insulation of the cable may be tested by means of an insulated wire inserted in the outer layer or strands forming the copper core.

For the purposes of initial tests when cable is installed, the joints in the sheath may be bridged by fine fuse wires, which are afterwards removed. Several methods are suggested for utilizing the pressure wire. The outer end of the pressure wire being insulated, periodic tests of this wire for insulation resistance will show any incipient fault in the main conductor. The wire may be used to read the pressure at the far end of the line. A secondary use of the pressure wire would be to calculate the temperature of the main conductor by measuring the variation in its resistance.

With high-tension lines some of the troubles due to the metallic sheath on low-tension cables are less marked. The metal sheath on high-tension cables must be earthed to prevent danger to life, and also to eliminate the risk of puncturing the insulation by cumulative static charge. It is unnecessary, however, to use insulating joints in the sheath of such cables, except in some special case where local conditions require them to prevent an excessive amount of stray current being carried.

### DISCUSSION.

Mr. H. W. Fisher thought that a voltage test upon a cable may be used for determining to a certain extent the quality of the rubber compound. A voltage test which would not injure a cable insulated with 30 per cent Para rubber might be sufficient to puncture a cable having a cheaper rubber compound. There are conditions under which rubber is not the best insulating material; it will not withstand under voltage stress the continued application of high temperatures, as well as other forms of insulation. There are some very prominent engineers in this country who, because of repeated burn-outs on rubber cables, are rather averse to them. Saturated paper-insulated cables certainly preponderate here, and they are giving excellent satisfaction.

Mr. H. G. Stott remarked that the condition of specifications for rubber-covered cables is an extremely chaotic one at the present. Each engineer has his own specifications, and the result is that the purchaser is almost entirely dependent upon the honesty of the manufacturer in building the cables. He showed the results of tests on samples of rubber-covered wires containing various percentages of Para, which indicated that a manufacturer who wishes to use reclaimed rubber can provide a cable which will show up better than a cable containing the specified amount of Para. From the tests it would appear that the variation of the insulation resistance with change in temperature is the best measure of the amount of Para used in the insulation compound. The stretching test, however, is absolutely unreliable.

Mr. Philip Torchio stated that the desirable features in the insulation of a cable are durability, a moderately high insulation resistance and high dielectric strength for high-tension cables. For a certain class of requirements cables built with less than 30 per cent of Para mixed with other ingredients will give a product of the same durability and the same general satisfaction as a 30 per cent rubber cable and yet save the purchaser a considerable percentage in cost. He thought that the proposed specifications should be made the foundation for the work of a special committee of the Institute to investigate and collect data on the subject. This committee should communicate with the English association of cable makers to obtain the benefit from their experience along the lines which led them to manufacture two types of rubber-insulated cables.

Dr. A. E. Kennelly said that the dielectric strength of the insulation does not depend solely upon the thickness of the wall, but upon the ratio of the external thickness to the internal thickness. It must always be kept in mind that the maximum dielectric stress will be exerted upon the inside layer, which should be constructed of the best and strongest dielectric materials, and the outside layers can be made up more and more of what might be called stuffing.

Mr. E. W. Stevenson, in comparing paper-insulated and rubber-insulated cables, stated that each has its special advantages and is suitable for certain duties. For extremely high-tension transmission and heavy power work, however, paper has almost entirely supplanted rubber. He agreed with Mr. Langan that the chemical analysis of rubber is not always practical, and that fairly good results can be obtained from mechanical tests. A convenient formula for determining the insulation resistance in megohms per mile for different sizes of wires is $R = 6{,}000 (\log D - \log d)$, where $D$ is the diameter of the insulation and $d$ is the diameter of the copper. This formula expresses the resistance at 60° F. after one minute electrification. Excessive pressure tests are unnecessary and dangerous. Although there is no objection to Mr. Langan's rule of using double the working pressure, 2½ times the working pressure is quite within safe limits, and this is generally understood throughout the country.

Mr. Townsend Wolcott stated that the Signal Corps has found that the best way to determine the amount of rubber in a compound is to have an inspector at the works to see the compound mixed. The determination of the amount of rubber by the acetone extract is a very uncertain matter, because rubber is not a definite chemical compound.

Prof. Durand Woodman said that when standard specifications are finally adopted they will include electrical tests, physical tests and some chemical tests. It is necessary to consider very carefully whether to adopt such a figure as 6 per cent of acetone extract, as such a quantity would allow for rubbers that are not Para.

Mr. William McClellan thought that any specification which calls for 30 per cent of pure Para rubber uniformly, without regard to the particular use for which the insulation is designed, is fundamentally bad from an economic standpoint. For a large portion of the work, 30 per cent Para is wholly unnecessary and much too expensive. It is noteworthy that the extractive matter could be considerably higher than 6 per cent, and yet a durable insulation obtained for many purposes.

Mr. C. F. Scott stated that in preparing specifications the operator should be considered as well as the manufacturer, and they should not be limited to the methods and materials used in manufacture. The cable is for use and the real essence of a cable test should be to determine its reliability.

At the conclusion of the discussion President Wheeler suggested that the standardization committee at its next meeting consider the matter and determine whether to appoint a special committee on cable insulation or to take it up themselves. The matter was referred to Dr. Kennelly, as secretary of the standardization committee.

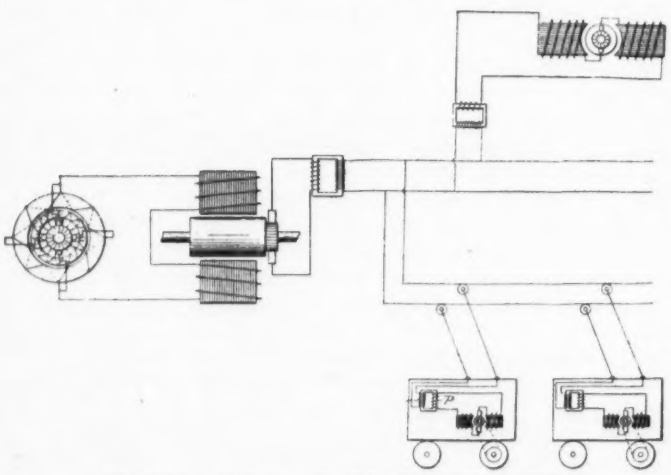
## Ithaca Meeting of American Electrochemical Society.

The ninth general meeting of the American Electrochemical Society commenced on May 1 at Ithaca, N. Y. At the beginning of the first meeting, which was held in the large lecture room of the Chemical Laboratory of Cornell University. President Schurman, of Cornell, presented a felicitous address of welcome. Prof. Bancroft, as president of the Society, replied.

A brief business meeting followed at which the results of the election of officers were announced, as follows: Mr. Carl Hering, president; Messrs. S. P. Sadtler, J. W. Richards and S. Reber, vice-presidents; Messrs. C. J. Reed, E. G. Acheson, C. F. Burgess, managers; Mr. P. G. Salom, treasurer, and Mr. S. S. Sadtler, secretary. A full report of the proceedings, with abstracts of the papers presented, will be given in our next issue.

## Low-Frequency Transmission System.

The accompanying diagram indicates a single-phase railway and power transmission system as proposed by Mr. Wm. Stanley in a patent issued April 17. The characteristic feature of the system resides in the production and use of single-phase current at a frequency of from three to fifteen cycles per second. It is evident that a series motor having laminated paths for the field flux will operate with five-cycle current practically the same as with direct current, so that a commutator motor for such a low frequency presents no difficulties in design or construction. The



STANLEY RAILWAY AND TRANSMISSION SYSTEM.

problem resolves itself into one of building a successful and economical low-frequency generator. The main generator illustrated differs from a direct-current machine merely in having a laminated field circuit and in being excited by low-frequency current; thus the frequency of the current delivered by it is independent of the speed of its armature, and it may be constructed for the most advantageous rotative speed. The exciter is a specially constructed low-frequency generator, and, though its weight might be large for its output, the effect of the increased weight would be relatively small in comparison to the output of the main generator.

## An Important Niagara Project.

At various times during the past few years it has been proposed to develop power at Niagara Falls by means of a canal from La Salle in the upper river to the mountain top at Lewiston, where, by a system of locks or a hydraulic lift, boats could be lowered into the lower Niagara River, the flow of water in the canal being utilized for power purposes. This plan has been modified at various times and now it is announced that Eastern capitalists have secured the franchise of the Niagara County Irrigation & Water Supply Company, and will build a canal from La Salle substantially along the line of the Deep Waterways Canal for 3½ to 4 miles, to a point where it diverges towards the Devil's Hole. There by means of a 300-ft. drop power is to be developed and the water returned to the river. Considerable work has been done at La Salle, and the company expects to begin work in the near future developing from 200,000 to 300,000 hp. The canal will be 200 to 250 ft. wide and 18 to 20 ft. deep, large enough for the passage of lake vessels, so that by dredging the channel of the Niagara River it will be possible for them to reach Niagara from all the lake ports.

Of the power developed, 30,000 to 50,000 hp will be used by new industries which are expected to locate in the immediate vicinity of the canal. A considerable amount of power will be transmitted, it is asserted, to Pittsburg, Cleveland and intermediate points.

The estimated cost of the complete development is between twenty and thirty millions of dollars. It is stated that the charter of the Niagara County Irrigation & Water Supply Company has not been affected by the recent State legislation and has been sustained by the New York State courts. The charter gives the company the right to an unlimited amount of water, but the company is willing to have the amount which it will divert restricted to a reasonable extent so as to leave it on an equality with the companies authorized to make developments on the American side of the falls. The Burton bill, as introduced in Congress, limiting use, would affect the enterprise, although it is not thought that the bill will pass as it now stands. It is claimed that the diversions proposed at Niagara represent such a small proportion of the flow in the stream that the falls will not be substantially affected, and the power generated will add so materially to the industrial and commercial welfare of the entire Western part of the State that it is believed the conflicting interests will arrive at some equitable adjustment.

One feature of the enterprise is that, in putting through this development, over one-half of the Deep Waterways Canal will be built and maintained free of expense to the people. When the canal is completed all the lake ports will have free passage past the falls, on American soil; so that with the Deep Waterways and the thirteen railroads which center at Suspension Bridge, Niagara Falls will become, by means of the cheap power and unlimited transportation facilities, one of the great industrial centers of the world.

With this development a fall of 300 ft. will be available. This is over twice the average fall utilized by the companies at Niagara Falls, so that any water used at this site gives twice the power used at the average plants already developed at Niagara. In other words, if any additional water is to be diverted at Niagara the water can here be used in a way which will give the greatest possible development to the industries in New York State. Complete plans of the enterprise have been prepared by Messrs. Vielé, Cooper and Blackwell, of New York.

## The Situation in San Francisco.

News this week is more cheering, though the immensity of the task of restoration becomes daily more apparent. Telegraphic and telephonic service is being rapidly resumed, and fortunately the underground wires and cables have been found generally in good condition—a long step toward renewal of operation. On May 1 arc lighting was resumed in the Potrero district of the city, and some of the street car lines are running, the Market Street cable route, trolleyized, being one of them. Electrical supplies, material and men are pouring into the district and the call comes for more. In addition to the concerns reported in these pages last week, the Westinghouse Electric & Manufacturing Company reports the loss of its offices and of its warehouse, with $160,000 of stock. Abner Doble Company inform us of the destruction of their old shops and the immediate construction of new. The power plants in San Francisco, owing to their suburban location, appear to have been fortunate in escaping any serious damage, so that the ability to supply energy in any quantity as soon as needed, is unimpaired. It is believed that the great facility of installing electric lamps, motors, heaters, etc., will lead to an enormous demand during the reconstruction of the city, and permanently thereafter.

# CURRENT NEWS AND NOTES.

*PHILADELPHIA SUBWAYS.*—Mayor Weaver has approved the plans for the construction of the Philadelphia Rapid Transit Company's Market Street Subway east of the City Hall. The building of the underground electric road will be pushed so that it can be running within two years.

*FUEL AND FURNACES.*—At the regular monthly meeting of the New England Street Railway Club, held at the American House, Boston, on Thursday evening, April 26, a paper was read by Mr. John S. Schumaker, of the Farrell Foundry & Machine Company, Ansonia, Conn., on the subject of "Fuel and Boiler Furnaces."

*ATLANTIC WIRELESS.*—At the present time wireless communication across the Atlantic does not appear to be attended with great difficulty. The Cunard liner *Campania,* on her last passage from New York, eastward, established communication with Poldhu, in Cornwall, when 2,350 miles from the English coast. When 1,850 miles from Poldhu news messages were received both from Europe and from America.

*ELECTRICAL ESSAYS IN SCHOOL.*—Another central station has tried with success the idea of giving prizes for the three best essays on electricity in the household, written by public school children. The Mifflin County Gas & Electric Company, of Lewiston, Pa., offered three such prizes recently to students in the Lewiston High School. One of the essays sent us, the work of a girl of sixteen, is excellent, and shows that the rising generation has a keen idea of what electricity is going to do and can do for the housewife of to-day and of the future.

*TELEPHONE RATES.*—Chief Engineer Harry P. Nichols, of the New York Bureau of Franchises, in a report to the Board of Estimate expresses doubts as to the desirability of having more than one telephone company in the field and recommends that negotiations be opened with the New York Telephone Company for the establishment, if possible, of tolls and franchise payments on the same basis that is proposed for the Atlantic Telephone Company. The New York company has made progressive reductions for several years, and particularly since the introduction of the measured-rate system.

*THE TELEPHONE ANTI-RELIGIOUS.*—At a business meeting of the authorities of the Camden Old Order Dunkard Brethren Church, held at Camden, Ind., it was decided that all members of that church must have their telephones taken out at once. These people entertain the peculiar idea that the telephone does more harm than good, and that it is virtually irreligious. The telephone has been a subject of much argument among the members of the denomination, but this is the first compulsory law made by the brethren to taboo the service. The subject was hotly contested last summer in the national meeting, but was finally left to the individual conscience of the user. The Camden ruling affects only the members of this one church.

*N. E. L. A. TRANSPORTATION.*—The approaching convention of the National Electric Light Association promises to be most interesting and important. The papers arranged for by President Blood cover a wide range of topics, and the authors are men eminent in their respective branches of the profession. In addition to the convention proper, there will be an exhibition by the associate members, occupying the large hall at the entrance to Young's Pier, which has been noted elsewhere in this issue. On one of the days the committee expects to take the ladies attending the convention to Philadelphia, where luncheon will be served at the Bellevue-Stratford. Efforts are also being made to secure an exhibition drill of either the beach guards or the United States Life Saving Crew at the Atlantic City stations. The hotel circular will be issued in a few days. Any other information regarding the convention can be obtained at the secretary's office, 136 Liberty Street, New York City.

*TELEGRAPHY IN ENGLAND.*—A plan is under consideration in England, it is said, to reduce the cost of a six-word telegram, including the address, to 6 cents. Meantime there is agitation for a cheaper telephone service, although it is the telephone that so constantly undermines the telegraph income. Mr. J. Henniker Heaton, the well-known champion in the British Parliament of cheap postage, is now seeking to provide a telephone for every householder at a cost not greater than 24 cents a week. In Great Britain the post-office department comes into control of the telephones in 1911, but Mr. Heaton thinks that cheap telephones, with underground wires, should be provided before 1911, as it would mean an annual saving of "millions of dollars."

*CANADIAN TELEPHONE CONTROL.*—A bill was introduced last month in the Dominion Parliament, the chief feature of which is the control given of telephone rates, to the railway commission. The minister of justice announced that it was the intention of the Government to make this control as effective as that now exercised over railway freight and passenger rates by the same tribunal. The bill also provides for the interchange of traffic between telephone companies, and removes a barrier to the entrance of independent telephones to railway stations, abolishing in settling the compensation any exclusive contract between the railway and any other telephone company. The leader of the opposition has given assurance that he will do all he can to assist in perfecting the telephone measure. Its passage, therefore, is virtually assured.

*NEW YORK ELECTRICAL SOCIETY.*—The New York Electrical Society held its 258th meeting at the Edison Auditorium, 44 West Twenty-seventh Street, Wednesday, April 25. The address of the evening was on the subject of "News, Newspapers and the Telegraphic Art," by Melville E. Stone, general manager of the Associated Press. In view of the interest in the disastrous earthquake and fire at San Francisco, the officers of the Society supplemented this with special addresses bearing on the catastrophe. President Barstow gave a sketch of the remarkable power transmission development in California, for which San Francisco is the focal point, and Dr. F. A. C. Perrine, speaking on the same subject, showed on the screen some of the most interesting features of these installations, together with many of the buildings in San Francisco which have been destroyed. Mr. Stone gave a lucid exposition of the development of news gathering and of the extraordinary achievements which telegraphy now renders possible.

*AUTOMOBILES AND TELEPHONY* do not appear closely related, but it is the fact that telephone companies, like electric light and power companies, use the machines to advantage. Mr. Leland Hume, general manager of the Cumberland Telephone & Telegraph Company, Nashville, Tenn., states that the corporation now owns and operates fourteen machines of the runabout type that are used daily by the "trouble men" and installers. Six of these machines are used in and around Nashville, where the country for a radius of 100 miles is traversed by macadamized turnpikes, along which the company owns and operates long-distance and local telephone lines. When a line is found out of order and the trouble is 20 miles from Nashville, it can be reached in an hour and a half. Under the old mode of conveyance by horse and wagon two-thirds of a day was required to reach the trouble. As a result the use of the automobile has been of great advantage to telephone subscribers and users, because it minimizes the time that any line remains out of order. Mr. Hume himself uses an automobile almost entirely in inspecting the long-distance lines in Kentucky and Tennessee, and in visiting the 150 different exchanges in that territory. It is said that each machine costs twice as much as a horse and buggy, but does easily three times the work.

*A BELL TELEPHONE CONVENTION.*—The annual meeting of the contract agents of the Bell Telephone companies of the United States and Canada is announced to begin in Atlanta on May 8 continuing one week. There will be addresses by prominent officials, and other attractive features on the programme. Two or more representatives from each of the Bell Telephone systems will be present besides others interested. These meetings have usually been held in the North and East, but it was decided this year to bring the convention South partly on account of the growth of the business there.

*WHAT SUBWAYS COST.*—Before a commission appointed to hold public hearings as to the necessity of building on several routes designated by the Rapid Transit Commission, in New York City. George S. Rice, chief engineer of the permanent commission, gave the estimated cost of all the subways on the 19 routes approved by the commission as $450,000,000. He said that a subway in Third Avenue would cost $39,000,000 and would probably carry 600,000 passengers a day. A subway up Seventh and Eighth Avenues, he said, would cost $40,000,000. The cost of municipal operation he estimated at 60 per cent of gross receipts, while the present subway is being operated at 50 per cent.

*JERSEY-NEW YORK TRAVEL.*—The Public Service Corporation of New Jersey, which operates the trolleys of Essex and Hudson Counties, has made an agreement with the Pennsylvania Railroad and the McAdoo tunnel interests by which it undertakes to abandon its own plans for a special Jersey terminal and high-speed line. By this agreement the Pennsylvania road and the McAdoo tunnel interests will build a high-speed electric line that will take passengers of the Pennsylvania at Harrison, and of the Public Service Corporation at Park Place, Newark, and land them in Manhattan, at Church and Cortlandt Streets, in fifteen minutes. These two companies are to co-operate in building the main Jersey terminal at Harrison.

*STREET RAILWAY CONVENTION.*—A meeting of the Executive Committee of the American Street & Interurban Railway Manufacturers' Association was held in New York April 27 to elect permanent officers, make arrangements for the Columbus convention next October, and adopt a permanent constitution and by-laws. The following officers were elected: President, James H. McGraw, president McGraw Publishing Company, New York; vice-president, Charles C. Peirce, General Electric Company, Boston; treasurer, E. H. Baker, Galena Signal Oil Company; secretary, George Keegan, Interurban Rapid Transit Company, New York. A committee was appointed to take up the details of the Columbus convention at which a very fine exhibit fully equal to that last year at Philadelphia is expected.

*TWO TELEPHONE SERVICES.*—In a recent interview, Controller Metz, of New York City, said flatly that he was opposed to any new telephone system on Manhattan Island. "I have read the report of Mr. Nichols to the board on the Atlantic grant, and I have been especially interested in what he says about the advantages of doing business with a single company. The telephone business is an essential monopoly, and two companies in a city means an infernal nuisance, with no saving. I have had experience in Philadelphia and in St. Louis, where in each city there are independent companies. My private business has offices in both cities. You have to bother with two books, with two exchanges, and have to keep a force of clerks busy hunting up telephone numbers, only to find that the man you want subscribes to some other system than the one whose book you have."

*CHICAGO TROLLEY PROBLEMS.*—A special dispatch from Chicago of April 28 states that Mayor Dunne has submitted to the chairman of the Council Transportation Committee what he considers final plans for the settlement of the traction question. He practically abandons immediate municipal ownership for immediate street car service improvement, and calls for the opening of negotiations with the present traction companies at once. The Mayor's plan contemplates having the companies improve their service and continue under a license and not a franchise for a definite period, and an agreement between the companies and the city whereby the municipality is ultimately to buy the street railway properties. The aldermen, without exception, have been stirred by the new attitude of Mayor Dunne, and the opinion prevails that he is making easy his backdown from his municipal ownership ideas in the near future.

*TROLLEY STREET CLEANING.*—In Brooklyn the Street Cleaning Department has a smaller mortality among its horses, by reason of the use of the trolley as an adjunct. Last year Borough Superintendent William S. Clarke reported that he had lost only 61 horses; the year before he had lost 77; the year before that 119, and in 1902, 168. The present system of bringing the waste to thirteen centrally-located receiving stations and removing it thence in large trolley cars is the reason. Under the old system the average haul to the inland dumps, scattered at various points over the area of Brooklyn, was estimated at nearly two and one-half miles for the round trip. In some instances the haul was nearer four miles. Now each of the receiving stations is the center of a rough circle having a radius of a mile. The average trip of the horse and cart to the station and back is, therefore, one mile also, the maximum being only two. Other humanitarian reasons are also apparent.

*NEW ENGLAND CONVENTION TRANSPORTATION.*—Mr. Charles H. Hodkinson, of Boston, master of transportation for New England for the National Electric Light Association, was in New York last week conferring with Mr. George F. Porter, master of transportation, regarding the facilities for carrying visitors to the convention in Atlantic City from New England points. Mr. Hodkinson is endeavoring to get 150 fares from Boston and vicinity, in which case he will be able to secure an entire special train to run direct to Atlantic City without change, via New York, New Haven & Hartford Railroad, and by transfer boat to Jersey City, thence to destination. If he is successful in pledging the above number the train will consist of baggage, Pullman and broiler and observation cars. There is a mistaken idea that to avail themselves of this excellent service all passengers must be members of the association. This is not the case, and Mr. Hodkinson will consider it a favor if all intending visitors from New England will communicate with him before completing their arrangements. He has already issued special circulars.

*ATLANTIC CITY PREPARATIONS.*—To begin the preparations for the convention of the National Electric Light Association the first week in June, Mr. Arthur Williams, chairman of the convention committee, and Mr. T. C. Martin, chairman of the committee on progress, visited Atlantic City last Friday and Saturday to make preparations and lay out carefully a large amount of preliminary work. As is already known, Young's Pier has been engaged for the week, and the exhibit and meetings will all be held there, right over the ocean, and cooled by sea breezes. A spacious hall provides for the main exhibits and already very little space is left owing to the demand, so that an overflow into the pier wings is probable. The exhibit of central station advertising material by the committee on progress also promises to be very large and to embrace a number of new features. This will be given in an adjoining hall, en route to the convention meeting place, further down the pier, which is of considerable length and width. The uniform plan of exhibit decoration and booth is found to lend itself admirably to the space provided, and the lighting and color scheme will prove very effective. While the convention is going on there will be in full swing on the pier without any interference concerts by an excellent band, a vaudeville theatre, a skating rink and net deep sea fishing, so that the variety of instruction, entertainment and amusement will be something never enjoyed before or under such favorable conditions for comfort. Inquiry brought out the fact that the reservations at the thirty-seven hotels on the association list are already very large, running up into the hundreds.

# Electricity at the New York Hippodrome.

THE great part played by electricity in modern spectacular performances and the extent to which electricity is used for utilitarian, decorative and advertising purposes in the modern playhouse are well illustrated in the electrical equipment at the New York Hippodrome. This building occupies the entire block from 43d to 44th Street on Sixth Avenue and is 240 ft. deep. It is built entirely of brick, marble and steel and has two electric towers abutting from either corner which rise to a height of 120 ft. above the sidewalk. The building is designed to be used exclusively for amusement purposes, principally those associated with circus, menagerie and aquatic performances. The seating capacity of the house is 5,200 persons.

### THE STAGE.

Not the least interesting is the stage and the novel arrangements for raising and lowering parts of it, filling and emptying a large tank and handling the scenery. From the footlights to the rear wall the stage is 110 ft. deep and is divided into two parts. The main stage, or that portion back of the proscenium arch is 60 ft. deep and 200 ft. wide. That portion of the stage between the curtain and the footlights, technically known as the apron, which in the average theatre is but a few feet deep, in the Hippodrome is 50 ft. deep and 100 ft. wide, elliptical in shape and large enough to accommodate two regulation circus rings each 42 ft. in diameter. Beneath the apron is a huge tank 14 ft. deep, which, when aquatic performances or naval pageants are to given, is filled with water. The movable apron may be submerged in this tank to various depths so that this portion of the stage, may be converted into a creek, lake or rushing mountain stream. The tank is built of concrete on rock bottom and its walls are reinforced with I-beams and channels.

The greater portion of the main stage consists of a movable platform carried on four girders and held up by four 12-in. plungers. These plungers are raised by hydraulic pressure, automatic equalizing valves compelling all four to travel at the same speed. The steel guiding columns are provided with dogs which lock the stage at any desired height. The dogs are operated simultaneously by two lines of countershafting extending the width of the stage. One line of shafting is placed in front and one line is placed in the rear of the stage lifting mechanism, and each is driven through a worm gear by a motor placed at the center of each countershaft. Hydraulic pressure is furnished by a triplex pump located beneath the stage. This is driven through double reduction gearing by a 40-hp, 220-volt motor and delivers water to a tank in which a pressure is maintained of 1,000 pounds by two accumulators. The latter consist of massive weights on top of steel plungers working in a cylinder. The accumulators are electrically connected with an Otis regulator and through it control the operation of the pump. The apron is also carried on 12-in. plungers, but has a maximum downward movement into the tank of 14 ft., while the main stage has a maximum upward movement of 8 ft. The normal position of the main stage and of the apron is level with the wings.

The three motor-driven centrifugal pumps which supply water to the tank beneath the apron are shown in Fig. 2. The pumps have a combined capacity of 8,000 gallons of water per minute. The small pumps are each direct-connected to a 16-hp motor and the large pump is direct-connected to a 40-hp motor. All the pumps' discharge to a 12-in. main connected to the tank. The motors which are of C. & C. make are controlled by Ward Leonard starting boxes. In the basement are also provided four ventilating fans each of which is driven by a 25-hp motor. The electric motors in use in the building for various auxiliary purposes have a combined rating of over 350 hp.

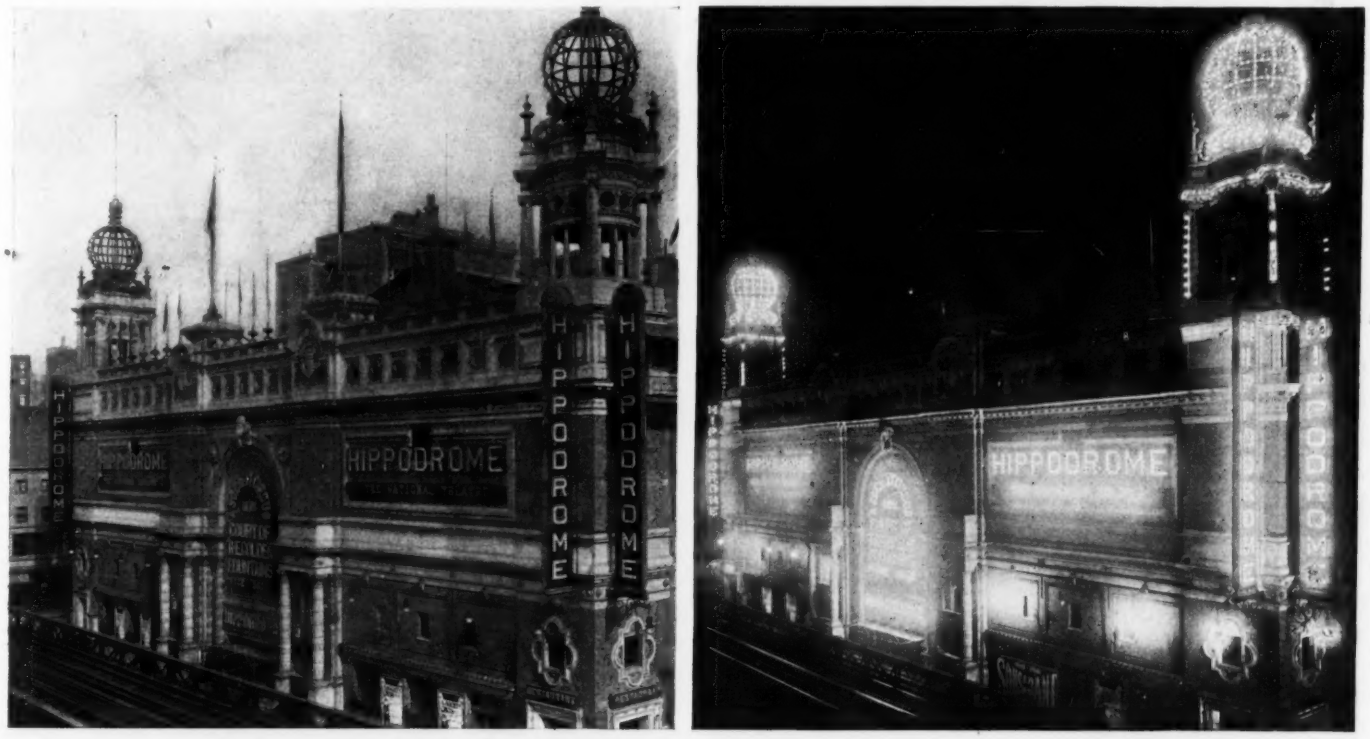



FIG. 1.—THE HIPPODROME BY DAY AND BY NIGHT.

### DISTRIBUTION OF CIRCUITS.

The system of lighting which has been installed at the Hippodrome is of interest on account of the many novel features involved and the magnitude of the installation. Over 20,000 incandescent lamps are connected in circuit, exclusive of the large number of miniature lamps and projector lamps provided for stage use and the lamps used for electric signs on the exterior which alone number many thousand. There are also installed eighteen low-voltage transformers for supplying alternating-current to miniature lamps for decorative purposes on the stage and a large number of plug sockets on the stage and in all parts of the building for temporary lighting supply. The lamps are arranged on 934 circuits which are controlled for the most part from the stage and dimmer switchboard and in part from the general house board located in the office. The motors are

supplied through eight circuits, and there are fourteen plug-socket circuits exclusive of the system for the stage.

The wiring for both the distribution and supply has been installed in a most thorough manner and in accordance with the latest practice of using conduit and metallic junction, outlet and panel boxes. Simplicity was secured by arranging for control from two independent switchboards for the different classes of service, and economy in the installation was secured by virtue of the more direct runs possible thereby. The general arrangement of the supply boards and distribution circuits

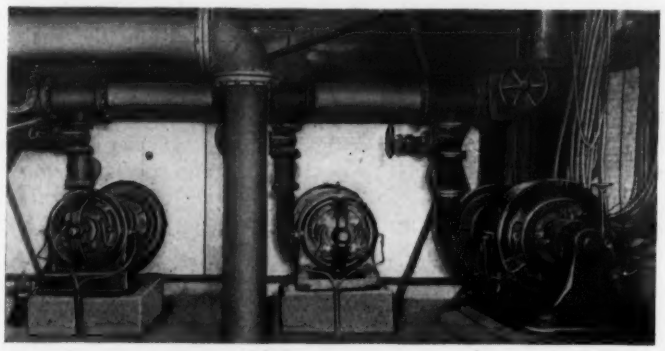


FIG. 2.—MOTOR-DRIVEN CENTRIFUGAL PUMPS FOR SUPPLYING TANK.

is well shown in the special feeder diagram reproduced herewith. It will be noticed that there are three incoming supply boards, two on the 43d Street side, one of which is for alternating current, and one on the Sixth Avenue front. These boards merely contain the meters and main cut-out switches and fuses. From the Sixth Avenue board heavy feeders are carried to the general house switchboard as shown, and individual

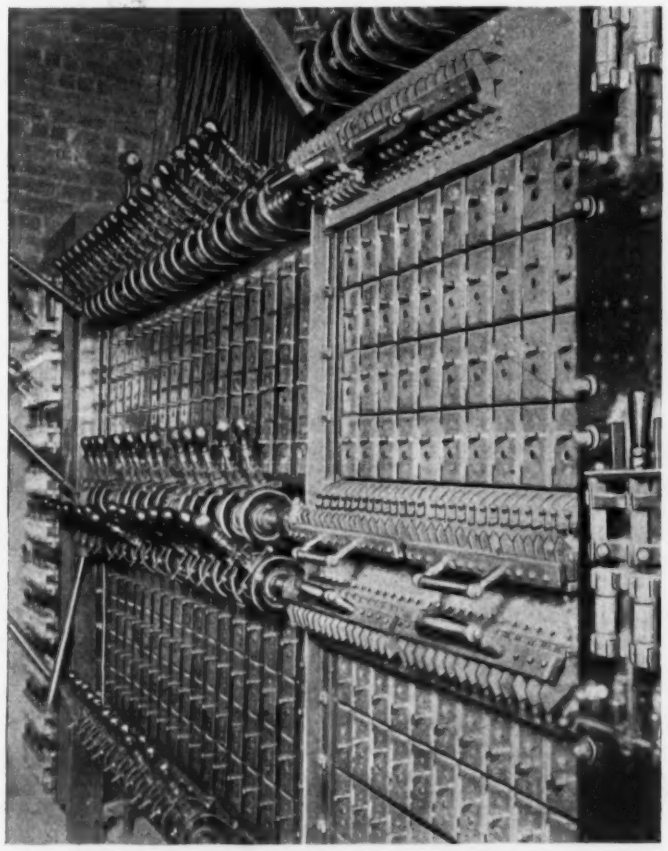


FIG. 3.—OPERATOR'S BOARD ON SWITCHBOARD GALLERY.

feeders are also carried directly to the lamps in the basement, which being required continuously are thus kept independent of the house board. The boards on the 43d Street side supply the stage and dimmer board through six large feeders, each consisting of a 4-in. conduit containing six 500,000 circular mil cables and a small feeder of two 300,000-circular mil cables supplies the motors in the basement for auxiliary service and the lighting circuits in the dressing rooms. The supply boards are interconnected by a heavy tie line in case of failure of either one.

The locations of the general house and stage and dimmer switchboards are indicated in Fig. 6. The general house board controls the lighting circuits for the office, lobby, all corridors

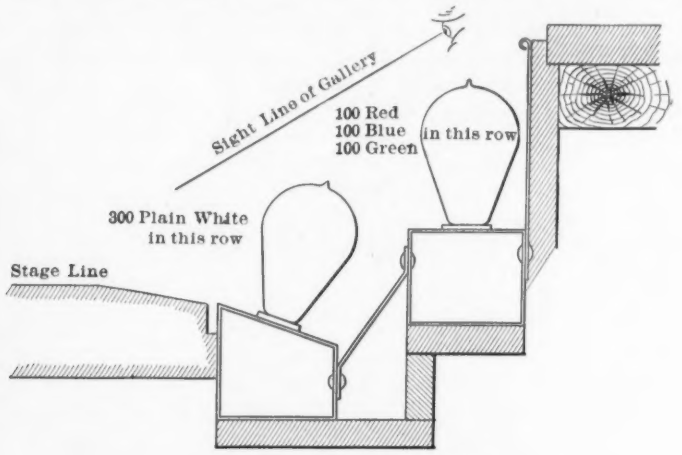



FIG. 4.—DETAIL OF FOOTLIGHTS.

on the main floor, balcony and gallery; the electric signs and decorative lamps on the exterior of the building, the cafe and a portion of the lamps in the basement are also controlled from this board. All the lamps visible in the auditorium, with, of course, the exception of the ruby exit lamps, are controlled from the stage and dimmer switchboard, and from here are also controlled all the ceiling and side lights, the footlights,

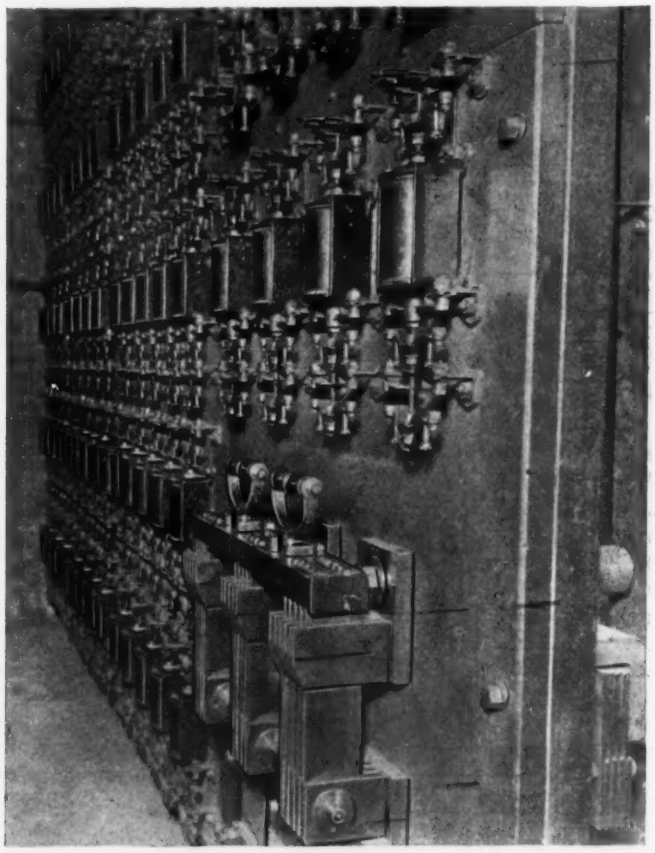


FIG. 5.—SOLENOID SWITCHES CONTROLLING STAGE LIGHTS.

border lights and miniature lights on the stage. The borders are of large proportions, over 3,700 lamps being used in the borders alone. These are arranged on 296 circuits, delivery to the drops being made through multi-conductor cables of 75 No. 12 wires for the first seven borders, and of 100 No. 12 wires for the rear four borders. The miniature lamps for the

decorative lighting are, as already stated, operated on low-tension alternating-current circuits, the transformers being located close to the outlets where the current supply is delivered.

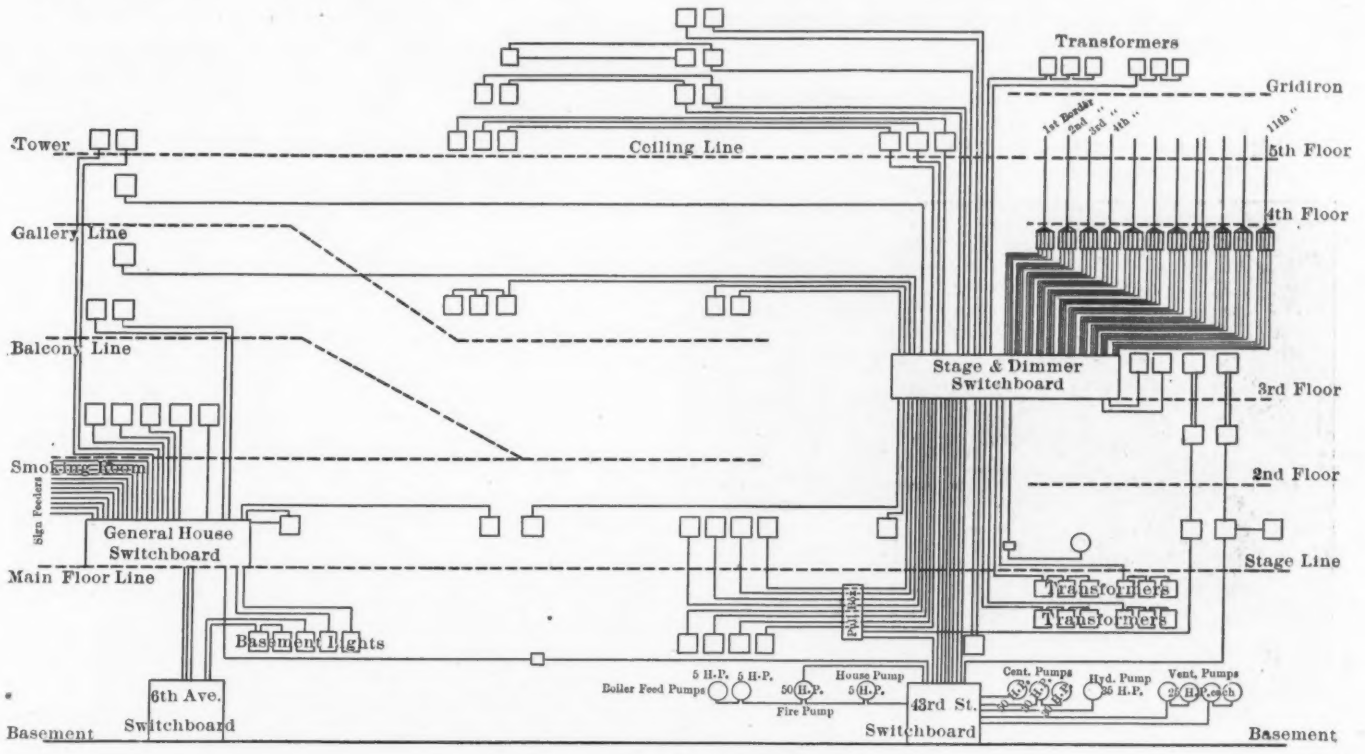



FIG. 6.—DIAGRAM OF FEEDER SYSTEM.

### APPLICATIONS OF ELECTRIC POWER.

Electricity is used for handling heavy scenery and for operating the drops. An elaborate crane system has been installed which operates on four concentric semi-circular tracks running from a pocket on one side of the stage to a pocket on the other side of the stage. The tracks are formed of 12-in. I-beams upon the lower flange of which are the trolley hoists. These are fitted with 2-hp motors for transverse operation and a 3-hp motor for hoisting. A cable wound around a drum fitted to each transverse motor is used to move the lifted scenery to one pocket or the other. The crane system is not used much at present, the scene shifters preferring to push the set pieces and use the hoists for lighter parts. All the motors are controlled from the floor of the stage by means of pull ropes. There is in addition in each wing of the stage a set of hoists for lifting set pieces of scenery, drop curtains, etc. Each hoist carries eight winding drums and each set of drums is driven by a 3-hp motor. The motor is connected to a shaft extending the length of the hoist frame, and the shaft of each hoist drum has a worm wheel driven on a vertical shaft. The upper end of the shaft carries a paper cone, and the motor-driven shaft carries two wooden cones for each winding drum, one on either side of the cone on the worm shaft so the winding drums may be turned in either direction. The lever for throwing the cones in contact latches as soon as contact is made between the cones, and the cable wound around the drum passes through a slot in the lever. Knots are tied on the cable at predetermined points and these in passing strike the lever, unlatching it, and the cones becoming thereby disengaged, the hoisting drum is stopped immediately. There are 60 separate drums provided in the two wings, each drum having a lifting capacity of about 800 pounds.

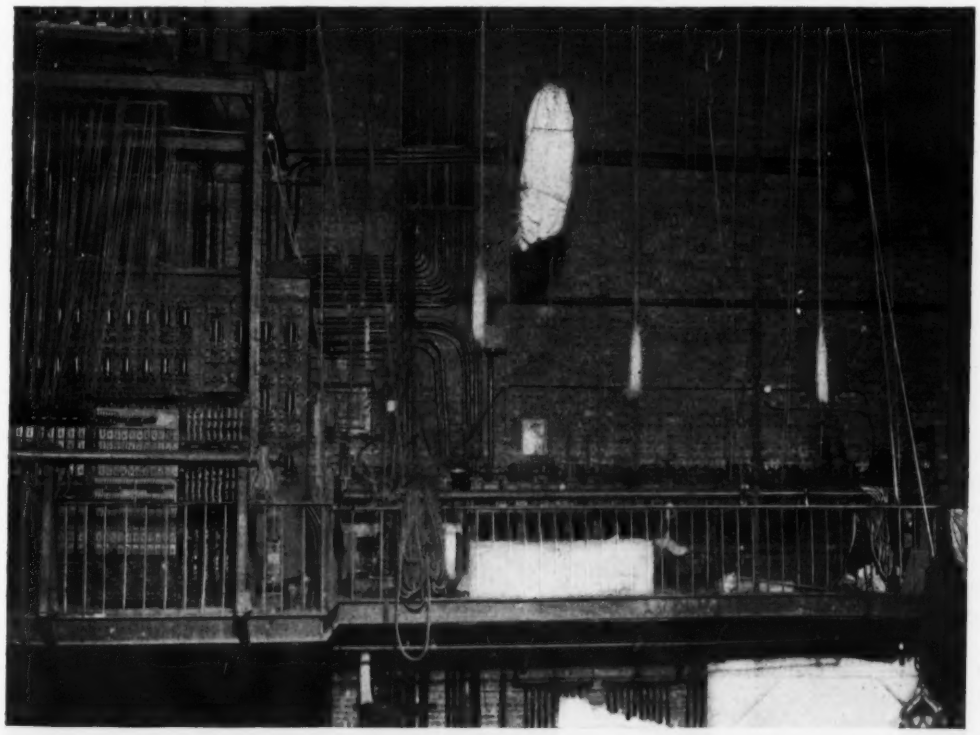


FIG. 7.—SWITCHBOARD GALLERY, SHOWING ALSO SCENERY HOISTS.

### STAGE SWITCHBOARD.

The stage switchboard for controlling the lamps is one of the most interesting parts of the Hippodrome equipment. The board is located in the 43d Street wing on a gallery 25 ft. above the stage floor so that the operator is in full view of the stage

at all times. The operator's board is made up of two panels containing 112 push-button switches which control as many solenoid switches on a board in the rear of the operator's board. These latter switches control the stage lighting circuits. To the left of the operator's board is a panel controlling the current for energizing the solenoids. At the top of the panel is a main switch and three triple-pole single-throw switches below which are arranged 24 switches for separate banks of solenoids which control different colored lamps. To the right of the operator's

FIG. 8.—EXAMPLE OF CORRIDOR LIGHTING.

board is the alternating-current switchboard which is connected with the United Electric Light and Power Company's board in the basement. The board in the operator's gallery controls the circuits for the miniature stage lamps; but in the present show no alternating-current is used, the service being kept merely as a reserve for emergency use in case of failure of the direct-current service.

The push-button switches are arranged in duplicate rows, there being two rows for controlling the white lamps, two for red lamps, two for blue and two for green. This arrangement enables the operator to set the lamps for one scene while another scene is being enacted, the switches for the following scene being disconnected from the solenoids. To throw in the new set of lamps one switch on the board to the left is thrown open and another closed. This, however, is too slow a method for changing the stage lamps inasmuch as it necessitates the opening and closing of switches for each color of light. The smaller panel is therefore equipped with throw-over switches, as shown in Fig. 3 by means of which the change may be made almost instantaneously, all colors being thrown in simultaneously.

The larger operating panel is divided into two parts by a row of dimmer handles, there being a row of dimmer handles across the top and another row across the bottom of the panel also. While the character of the lighting of the present attraction is such that the dimmers are preferably operated by hand, the dimmers are arranged for motor operation. On a framework behind the board are mounted four variable-speed motors each driving a screw carrying a nut. The nut is connected by a link to a lever on the shaft of the dimmer handles causing it to rotate as the nut moves backward or forward. Beneath the screw are snap switches, which are thrown by the nut when the latter reaches the end of its travel in either direction, so that the dimmers are not injured through the negligence of the operator.

All the lamps controlled from the stage are connected through dimmers, and each bank of dimmers is connected to a set of different colored lamps. Each dimmer shaft carries a pulley which is connected by belt to seventy-six 200-light theatre dimmers located in a gallery above the switchboard gallery. Interlocking handles control these pulleys permitting any circuit to be thrown out as desired. The motors operating the dimmers are controlled by starting boxes, located at the bottom of the smaller panel, the switches being set on a separate panel over the board. On the solenoid board is also installed a master solenoid switch which may be operated from a number of emergency switches placed in various parts of the house. This switch controls the glare lamps which stud the proscenium arch and which are sufficient to light the whole theatre adequately in case of accident. The lamps are connected to both the direct-current and alternating-current main, a relay on the back of the alternating-current board in the basement connecting the circuit automatically to either service in case of the failure of one.

### ILLUMINATION.

The auditorium is lighted chiefly by an immense sunburst in the dome forming the ceiling, the number of lamps forming the sunburst being in the neighborhood of 3000. In the inlay proper of the sunburst are 675 eight cp lamps. The ribs contain 400, and the rims over 600 lamps, all of 8 cp. In the outer rim forming the ceiling border are twelve hundred 16 cp lamps besides three hundred strip lamps made up of red, white and blue lamps in equal numbers. The clusters in the ceiling of the gallery and balcony each contain four 16-cp lamps and under the mezzanine floor are about five hundred 8-cp lamps studded in the ceiling. The elephant's head, the emblem of the proprietors, is the keynote in the ornamentation, and is found wherever the design of the building permits its installation. Each head is lighted by five incandescent lamps, three over the forehead of 8 cp and two of 32 cp tipping the tusks.

For the lighting of the stage both arc and incandescent lamps are used in large numbers. In the border lights over the stage are thirty-seven hundred 32-cp lamps, one half of which are white, the others being red, blue and green. In the footlights arranged as shown diagrammatically by Fig. 4, are six hundred 32-cp incandescent lamps, 300 white and 100 each of blue, red and green lamps. At the side of the proscenium are one hundred and forty-eight 32-cp lamps, and in mirror troughs are fifty 50-cp lamps. The mass lights which form a rim around the arch consist of one hundred and seventy-eight 50-cp mirror trough lamps. There are 125 portable trough strip lights each containing twelve 16-cp lamps used in all scenes in addition to 12 borders made up of twelve 32-cp lamps each at the bottom of the cyclorama which throw light upward in order to kill shadows made by the border and spot lights. Over 150 stage pockets are connected, some through resistance for arc lamps and others

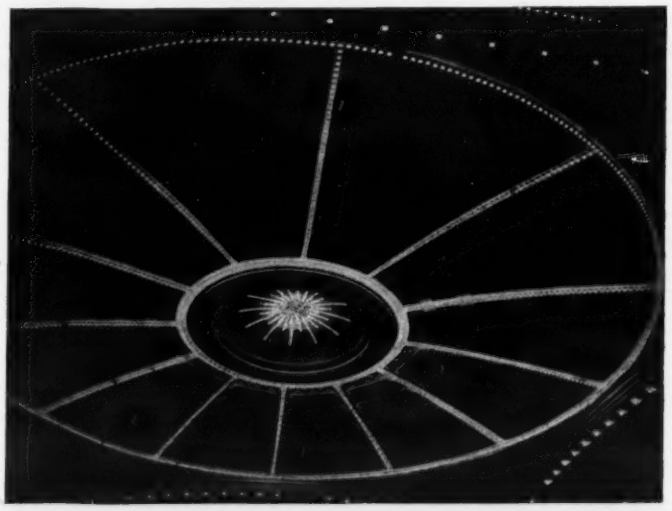


FIG. 9.—SUNBURST IN CEILING OF HIPPODROME.

through dimmers for incandescent lamps. In the center of the gallery back of two 10-ft. color boxes provided with eight color screens are 25 spot lamps, 20 of which require 30 amperes each and the others used for spot light work consume 50 amperes each. There are two spot light bridges on either side of the balcony, each bridge containing twelve arc lamps. Ten of these are used behind color boxes and consume 30 amperes each and the two used for strictly spot light work require 50 am-

peres each. In the dome of the ceiling are two holes back of which are two 75-ampere search lights for lighting the fountains from overhead. On either side of the apron are eight 6-in. spot lights back of color boxes, each lamp consuming 30 amperes; there are in addition four mirror back reflector lamps for the ballets which consume 50 amperes each. Back of the proscenium arch curtain line are two double bridges on either side of the stage. Each lower bridge has six 6-in. spot lights consuming 50 amperes each, and on the upper bridges are eight mirror-back reflector lamps consuming 50 amperes each. Over the center and back of the proscenium arch is a 30-ft swinging bridge on which are fourteen 50-ampere spot lights for lighting the cyclorama, and over the switchboard are six 50-ampere spot lights. On either side of the proscenium arch are the arc lamps for giving the lighting effects. In the second scene there are six effect machines used to produce cloud effects for a "Moon Song." Each of these machines requires 50 amperes and they are placed over the center arch of the scenery used in this act and fed from stage pockets. In the last scene there are in addition to the equipment mentioned below nine 50-ampere cyclorama arc lamps at the back of the scenery which throw light upward to heighten the effect of the tableau and also to kill shadows.

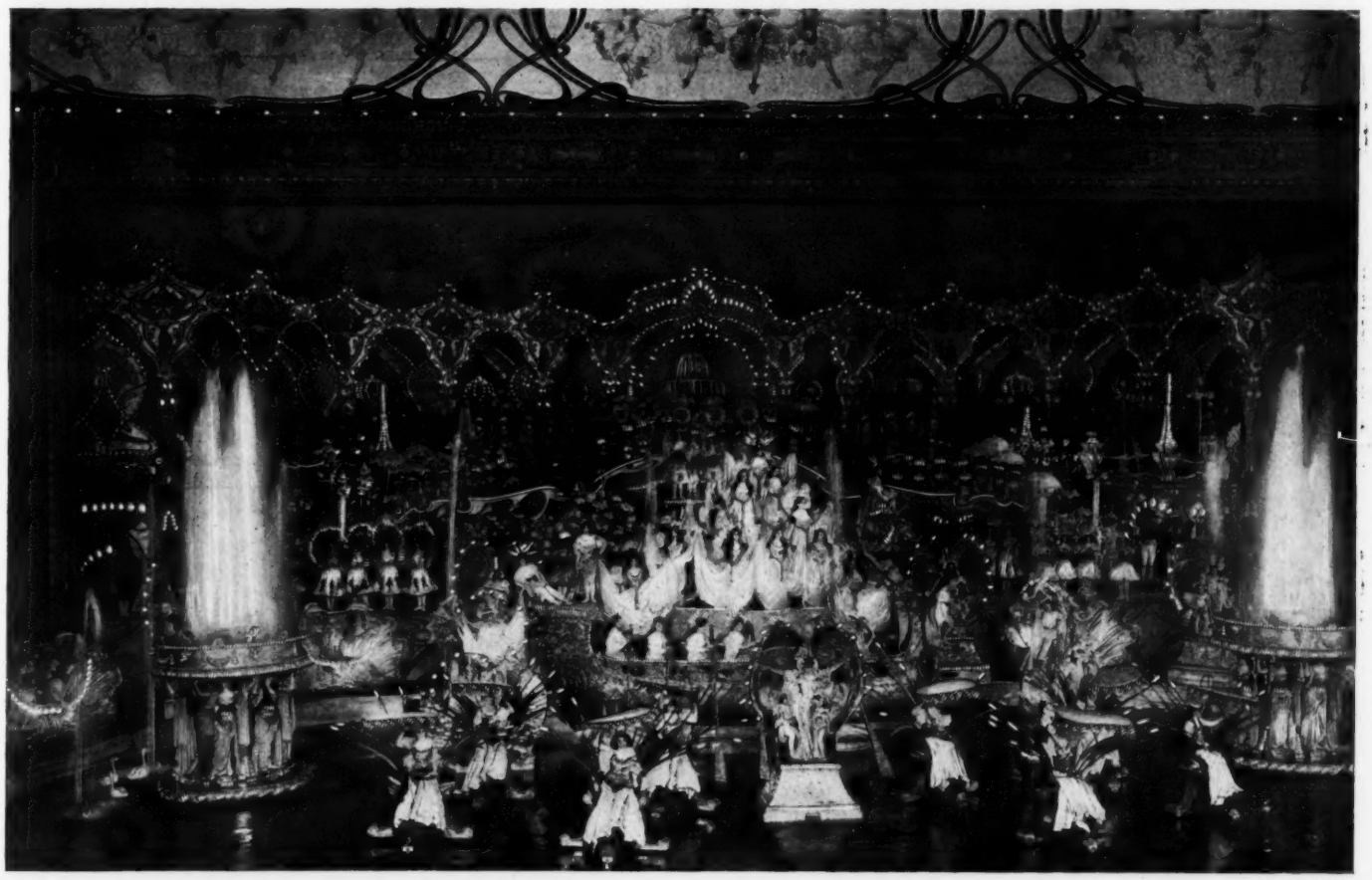


FIG. 10.—"COURT OF THE GOLDEN FOUNTAINS," THE ILLUMINATION OF WHICH REQUIRES OVER 10,000 AMPERES.

The "Court of the Golden Fountains," which is the final scene of the performance now running, is a spectacular aquatic tableau which neither words nor photographic reproduction can adequately describe. It is a notable example of scenic art of dazzling brilliance made possible only by the use of the electric light. In the center is a boat 36 ft. long and about 17 ft. high studded with 700 standard and miniature lamps. These are fed from two sets of stage pockets through cables run in ¾-in. rubber hose. The circuits are divided and fused in the boat and every other lamp in the outline is connected to one circuit so that should one feed line become accidently short-circuited the effect will not be noticeable to the audience. Around the apron are four 10-ft. sea shells 7 ft. high each seating two girls. There are forty 16-cp lamps connected to a double set of feeds concealed under the outer rim of each of these shells which serve to heighten the color of the shell. Each girl holds in her hand a string of pearls consisting of 17 ball-shaped incandescent lamps graduated in size from 32-cp at the bottom to 4 cp at the top of the string. There are also eight large-egg-shaped mussels which, as the curtain rises, are gradually opened by a girl secreted within each. Each of these mussels is lighted by sixteen 32-cp ball-shaped lamps placed around the edges. In front of the boat are arranged eight seats representing bullrushes. Each of these is provided with twelve leaves and at the tip of each leaf is a 16-cp bunkhole lamp specially dipped to give the desired color tone to the cattail which each represents. Twenty 16-cp lamps are concealed beneath the shell or umbrella over the head of the girl to light her face.

The two electric fountains on either side have each within them under a water-tight glass-covered color box a 75-ampere search light, and in the ceiling overhead, as already mentioned, is a 75-ampere search light also.

The color changes are made within the fountain and from the search light overhead both blending and giving a very pretty effect on the jets of water issuing from the fountain. One hundred and fifty submarine lamps are used to light the girls who seemingly support the fountain, and there are forty-two floating lilies, some below and some above the water, each of which is fitted with an electric lamp. Four girls, each holding a wreath of twelve 32-cp ball-shaped lamps stand on two dolphins, whose eyes are studded with green lamps and whose eight fins have eight forty-eight 4-cp lamps. Twelve 16-cp lamps are concealed in the mouth of each dolphin to heighten the effect. All the floats are fed through No. 10 stage cable encased in ¾-in. hose and connected to stage pockets around the footlights. No less than 2,000 ft. of rubber hose is used for this purpose. Seventeen hundred 8-cp lamps are laced to the scenery in the background. These are divided into circuits of 24 lamps each, fed from stage pockets through dimmers.

Before the curtain rises on the last scene the floats are rolled into place and the electric connections made. The main stage, with over 500 performers, is then elevated eight feet and the apron is submerged a few feet into the tank of water. The

water is then turned on to the fountains and as the curtain rises the entire lighting capacity of the stage board is thrown on through dimmers. Gradually the dimmers are cut out until full brilliancy is attained and for the space of about one minute over 10,000 amperes of current is consumed to light the gorgeous spectacle. The performance is given twice daily and the tableau at the afternoon performance comes on at about 5:15. Readers may imagine what such a sudden load means during the winter months to the station of the New York Edison Company which supplies the electric energy. The Edison Company requires no greater recommendation than that it has supplied this sudden demand nightly without a single failure.

MISCELLANEOUS.

Electricity is used in all the dressing rooms for curling irons and cosmetic heaters, there being 400 combined sets in use. The irons used for pressing the thousands of costumes used in the ballets are also electrically heated. In addition there are 28 ceiling fans and 18 stand fans in use during the warmer months. Electric carriage calls are installed on the 44th Street and 43d Street sides. Fig. 1 shows the exterior of the Hippodrome by day and by night. Arranged in rows across the face of the building are about six hundred 16-cp incandescent lamps. The towers and spheres are studded with over one thousand 8-cp incandescent lamps and in the four double-faced signs on the corners of the building are nearly fifteen hundred 8-cp lamps. In the other signs on the face of the building and over the doorway there are about two thousand 8-cp lamps employed, and 12 arc lamps are distributed across the front wall, making the building a blaze of light and attracting the attention of every passenger in the cars of the elevated railroad, and of pedestrians and others on the streets. The proprietors, Messrs. Thompson and Dundy, are firm believers in the use of electricity for advertising purposes and maintain a number of large electric signs in Manhattan and Brooklyn. At Broadway and 34th Street, one of New York's busiest corners, is a sign 40 ft. by 36 ft. with the words "Hippodrome, A Society Circus, Nine Blocks," with a hand pointing in the direction of the theatre. This sign is brilliantly illuminated by fourteen hundred 8-cp lamps, the name Hippodrome being in red, the rest in white light. It is also worthy of note as showing the enormous current consumption by arc lamps alone that the number of 9½-in., cored carbons used weekly in the arc lamps at the Hippodrome is a trifle less than 2,500.

Mr. Charles De Soria, of the New York Hippodrome, is responsible for the lighting effects, and it is to him that we are indebted for the information contained in this article.

## The Distribution of Illumination in the Neighborhood of Two Lamps.

By J. R. Benton.

THE distribution of illumination in the neighborhood of a single source of light follows a very simple law, being inversely proportional to the square of the distance from the source; but when illumination takes place from several sources its distribution becomes far more complicated, and cannot generally be computed in advance. In practice, illumination is very frequently effected by using several sources, as when lamps are placed at intervals near the ceiling of a room. It would be advantageous if the illumination to be obtained at any point by such an arrangement could be computed in advance, since the information gained by a mathematical study of the conditions would be helpful in deciding upon the best number, spacing, and power for the lamps to be used.

If the intensity of illumination upon any surface depended simply upon its distance from the various lamps, it would be very easy to calculate it by summing together the illuminations produced upon it by each of the lamps separately; but in reality the intensity is proportional also to the cosine of its angle of incidence upon the surface, which makes calculations impracticably laborious. Besides this, the thing of interest is not always the intensity of illumination upon a fixed surface, but sometimes it is more important to know the maximum intensity which can be obtained at a given point by turning a surface into different positions at that point. This would be the case where the illumination is to serve for reading, as in a church; each person naturally holds his book in such a position as to obtain the maximum illumination upon it.

The problem is then to find the maximum intensity of illumination which can be obtained at any point from a number of sources of light acting together. When the number of sources is very great, the number of independent variables involved is so large that any formula which might be worked out would be inconvenient to use; but in case only two sources come into consideration, the problems which arise may be handled rather simply with the help of the table given below. The case to which this table is applicable occurs when a room or hall is to be lighted from two chandeliers, each of which may usually be considered as a point source of light. The problems which arise in planning for such an arrangement are as follows: (1) When the positions of the two sources and their candle-powers have been fixed upon, to find the resulting intensity of illumination at any point; (2) when the positions, but not the powers, of the two sources have been fixed upon, to decide what is the proper candle-power for each in order to produce a given illumination at given points; (3) when the positions of the sources have not been fixed upon, to ascertain how they should be placed in order to get the best distribution of light in a room of any given shape and size.

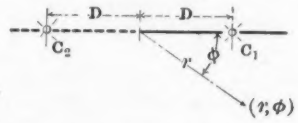



FIG. 1.—DIAGRAM ILLUSTRATING THE MEANING OF $r$, $\phi$ AND $D$.

To solve these problems, it is necessary to make use of a system of co-ordinates in order to define the position of points. It is obvious that the distribution of illumination is symmetrical with respect to the line passing through the two sources of light. It will be sufficient, then, to define the positions of points, if plane polar co-ordinates are used, taking as origin a point midway between the two sources, and as line of reference the straight line joining the two sources. This is illustrated in the diagram of Fig. 1. On this system let $r$ be the radius vector and $\phi$ the vectorial angle. Let $C_1$ and $C_2$ be the candle-powers of the two sources and $D$ the distance of each from the origin. Then the expression for the maximum intensity obtainable at any point as a function simply of $r$ and $\phi$ is as follows:

$$I_{max} = \sqrt{\left(\frac{C_1}{D^2 + r^2 - 2r\,D\cos\phi}\right)^2 + \left(\frac{C_2}{D^2 + r^2 - 2r\,D\cos\phi}\right)^2 + \frac{2C_1C_2\,(r^2 - D^2)}{[D^4 + r^4 + 2r^2D^2\,(1 - 2\cos^2\phi)]^{3/2}}} \qquad (1)$$

If the two sources are of equal power, as would usually be the case in practice, this expression becomes:

$$I_{max} = C\sqrt{\frac{1}{(D^2 + r^2 - 2r\,D\cos\phi)^2} + \frac{1}{(D^2 + r^2 + 2r\,D\cos\phi)^2} + \frac{2\,(r^2 - D^2)}{[D^4 + r^4 + 2r^2D^2\,(1 - 2\cos^2\phi)]^{3/2}}} \qquad (2)$$

This expression is a formula which may be used to find the maximum intensity of illumination at any point $(r, \phi)$ when the power of the sources and their positions have already been fixed upon. In practice the converse problems are of much greater importance, namely, to find the proper candle-powers and positions of the sources in order to have them produce a certain intensity of illumination at a given point, or at all points within some pre-

scribed space. These problems may be handled most conveniently with the help of the following table, mentioned above, which gives values of $D^2$ times the coefficient of $C$ in equation (2) for all values of $\phi$ and $r/D$. That is to say, the numbers in the table are values of $I D^2 \div C$, where $I$ stands for the maximum intensity of illumination at the point $(r, \phi)$, $C$ is the candle-power of each of the sources, and $D$ is one-half the distance between them. The

VALUES OF $(I D^2 \div C)$ FOR DIFFERENT VALUES OF $\phi$.

| $\frac{r}{D}$ | 0° | 10° | 20° | 30° | 40° | 50° | 60° | 70° | 80° | 90° |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.5 | | | | | | 1.33 | 1.05 | 0.863 | 0.752 | 0.716 |
| 1.0 | | 32.9 | 8.29 | 3.74 | 2.16 | 1.43 | 1.05 | 0.848 | 0.740 | 0.707 |
| 1.2 | 25.2 | 13.2 | 5.49 | 2.85 | 1.74 | 1.20 | 0.904 | 0.740 | 0.656 | 0.630 |
| 1.5 | 4.16 | 3.64 | 2.44 | 1.65 | 1.16 | 0.866 | 0.689 | 0.585 | 0.530 | 0.512 |
| 1.8 | 1.69 | 1.53 | 1.28 | 1.00 | 0.773 | 0.627 | 0.524 | 0.459 | 0.424 | 0.412 |
| 2.0 | 1.11 | 1.05 | 0.911 | 0.752 | 0.616 | 0.513 | 0.440 | 0.393 | 0.366 | 0.358 |
| 2.2 | 0.792 | 0.760 | 0.675 | 0.585 | 0.497 | 0.426 | 0.373 | 0.338 | 0.318 | 0.312 |
| 2.5 | 0.526 | 0.513 | 0.472 | 0.422 | 0.372 | 0.330 | 0.297 | 0.274 | 0.260 | 0.256 |
| 3.0 | 0.312 | 0.309 | 0.291 | 0.271 | 0.249 | 0.228 | 0.212 | 0.200 | 0.192 | 0.190 |
| 4.0 | 0.151 | 0.150 | 0.146 | 0.140 | 0.134 | 0.127 | 0.122 | 0.118 | 0.115 | 0.114 |
| 10.0 | 0.0206 | 0.0206 | 0.0205 | 0.0204 | 0.0202 | 0.0201 | 0.0199 | 0.0198 | 0.0197 | 0.0197 |

use of this table in solving the above problems may best be explained by a few examples.

To ascertain from this table the maximum intensity of illumination at a point $(r, \phi)$, due to two sources, each of power $C$, and placed at the points $(D, 0°)$ and $(-D, 0°)$, find the number in the table corresponding to the assigned values of $\phi$ and $r/D$; multiplying this number by $C$ and dividing by $D^2$, gives the required intensity of illumination. As an example, suppose that there are two sources of light, each of 50 cp, and placed 3 meters apart; it is required to find the intensity of illumination at a point 2 meters directly below the point half way between the two sources. In this case $C = 50$, $D = 1.5$, $r = 2.0$, $\phi = 90°$, $r/D = 2/1.5 = 1.33$. Looking in the table in the column for 90°, it is noted that when $r/D = 1.33$, the number to be taken from the

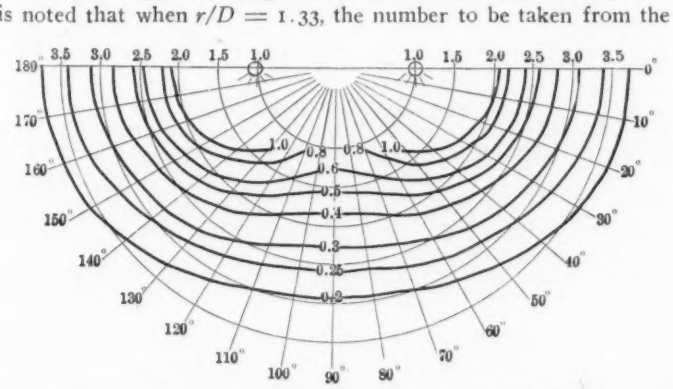



FIG. 2.—LINES OF EQUAL INTENSITY OF ILLUMINATION.

table lies between 0.630 and 0.512, and by interpolation it is found to be 0.58. Multiplying this by 50 (the value of $C$) and dividing by $(1.5)^2$, the value of $D^2$, the required intensity of illumination is given as 13 candles per meter square.

The following may be taken as an example of the converse problem; that is, to find the proper candle-power of the sources necessary to produce a given intensity of illumination at a given point: A hall 12 meters long by 6.8 meters wide is to be lighted from two chandeliers 3 meters above the floor, equally distant from the ends of the hall, and 4 meters from each other; what candle-power should be provided in order that the intensity of illumination in the corners may be sufficient for comfortable reading? Taking the intensity for comfortable reading as 4 candles per meter square, $I = 4.0$, and $D = 2.0$ meters. To find $r$ for the corner, assume that a book will not be held nearer to the floor than 1.0 meter, so that the point $(r, \phi)$ will be in the corner and one meter above the floor. The $r = \sqrt{6^2 + 3.4^2 + 2^2} = 7.2$ meters; and $\phi = cos^{-1}\, 6/7.2 = 33.5°$, $r/D = 7.2/2 = 3.6$. By the use of the table, these values of $\phi$ and $r/D$ indicate by interpolation the number 0.19, which is to be set equal to $I D^2/C$. Whence $0.19\, C = 4.0 \times (2.0)^2$, or $C = 84$ cp, which should accordingly be supplied at each chandelier.

This gives the candle-power necessary to produce proper intensity of illumination in the corners, but does not prove that the intensity will be sufficient at all other points. In order to ascertain the intensity at other points, further investigation is necessary. For this purpose it is very convenient to make use of Fig. 2, which shows graphically the distribution of illumination, by means of lines of equal illumination. In this figure $D$ is given unit length and a set of lines is drawn, each one of which connects all points at which the maximum intensity of illumination is the same. Each line is marked at the middle with numbers which give the intensity corresponding to it when $C$ is taken as 1 and $D$ as 1. The diagram is limited to a plane, while in reality there are surfaces of equal illumination reaching into three dimensions; the latter are the surfaces of revolution which would be traced by the lines of the diagram when rotated about the line through the two sources.

This diagram may be taken as representing the state of affairs in the problem under discussion if the scale be so chosen that $D$ is equal to two meters. The numbers attached to the various lines will then represent the intensities of illumination in the problem if they are multiplied by 84, the value of $C$. The figure shows that the point where $r = 3.6\, D$ and $\phi = 33.5°$ falls just outside of the line marked 0.2, as it should. If, now, all the other points in the region to be lighted fall within this line, they will get more illumination than the corners of the hall; otherwise they will get less and be insufficiently illuminated. It is clear that the darkest part of any cross-section of the hall will be that next to the walls; and if all the points along the walls be mapped out on the figure, it can be seen whether there is sufficient illumination at all points. To do this $r$ and $\phi$ can be computed for a few of the points and then a continuous line can be drawn connecting them. Thus at the point on the wall, at the center of the hall, and 1 meter above the floor, $r = \sqrt{2^2 + 3.4^2} = 3.9$ meters, and $\phi = 90°$. $r/D = 2.0$, nearly. Referring to the figure, it is noted that the point where $r = 2\, D$ and $\phi = 90°$ is well within the line marked 0.2; and it is seen that all points along the wall and therefore all points throughout the hall are sufficiently illuminated. Thus 84 cp at each of the chandeliers is sufficient for comfortable reading at all parts of the hall.

It is to be noticed that with the above arrangement the intensity of illumination near the center of the hall is far greater than necessary. By referring to the figure, we see that at the wall in the center of the hall (the second of the two points considered, where $r$ equalled $2.0\, D$ and $\phi = 90°$) the intensity is nearly twice as great as in the corners. It is clear that the light might be better distributed if the two chandeliers were placed nearer to the ends of the hall; and this leads to the problem of determining how far apart the two sources should be placed for the best distribution of light.

As the two sources are separated more widely, the corners of the hall receive more light, but the points between the two sources receive less. The best distribution will be attained when they are so spaced that the intensity of illumination in the corners will just equal that on the wall opposite the point midway between the two sources. In the example chosen this requires that the intensity should be the same at the points $(7.2, 33.5°)$ and $(3.9, 90°)$. The problem consists, then, in finding the value of $D$ for which this condition will be fulfilled. This may be ascertained by trial, assigning different values to $D$, and finding from the table the corresponding intensities at the two points in question. The work may be tabulated as follows:

| Value of $D$ assumed. | $r/D$ for the point $(7.2, 33.5°)$ | $r/D$ for the point $(3.9, 90°)$ | Intensity, from table, ($C$ being the candle-power of one of the sources) for the point $(7.2, 33.5°)$ | for the point $(3.9, 90°)$ |
|---|---|---|---|---|
| 2.0 meters. | 3.6 | 2.0 | 0.048 C | 0.090 C |
| 3.0 " | 2.4 | 1.3 | 0.051 C | 0.066 C |
| 3.5 " | 2.1 | 1.1 | 0.052 C | 0.054 C |
| 3.6 " | 2.0 | 1.1 | 0.054 C | 0.054 C |
| 4.0 " | 1.8 | 1.0 | 0.058 C | 0.044 C |

It appears, therefore, that the most advantageous positions for the two sources are obtained when each is 3.6 meters from the center of the hall. For this position the required candle-power is determined from the relation: $0.054\, C = 4.0$ candles per meter square, so that $C = 74$ cp, instead of the 84 required when $D$ was taken as 2.0 meters.

If a single chandelier at the center of the hall had been used, the candle-power necessary to produce 4.0 candles per meter square at the corners would be determined by the relation: $C/(7.2)^2 = 4.0$, whence $C = 207$ cp, or in practice, thirteen 16-cp lamps. When two chandeliers are used, placed in the best position, only five lamps are required in each, or ten in all, so that a saving of 23 per cent is effected.

The best spacing for two sources depends on the dimensions of the space to be lighted, and also upon the height of the sources above the floor (or other surface upon which the illumination is desired). It is possible to work out the best value of *D* for a number of different dimensions of hall, and tabulate the results for future reference. If such a table is computed it will be found that for all ordinary dimensions of halls and heights for the chandeliers, the best value for *D* comes out almost exactly 0.3 of the length of the hall in every case.

## The Lighting of Desks.

By J. R. Cravath and V. R. Lansingh.

IN the lighting of desks there are five principal requirements:

1. The light should be out of the line of ordinary vision of the person working at the desk or should be shaded so that the rays cannot strike the eye.

2. The position of the lamp with reference to the top of the desk should be such that the worker at the desk will not receiv the regular reflection or glare from paper on the desk. This regular reflection is one of the commonest causes of trouble in continued working at an artificially lighted desk.

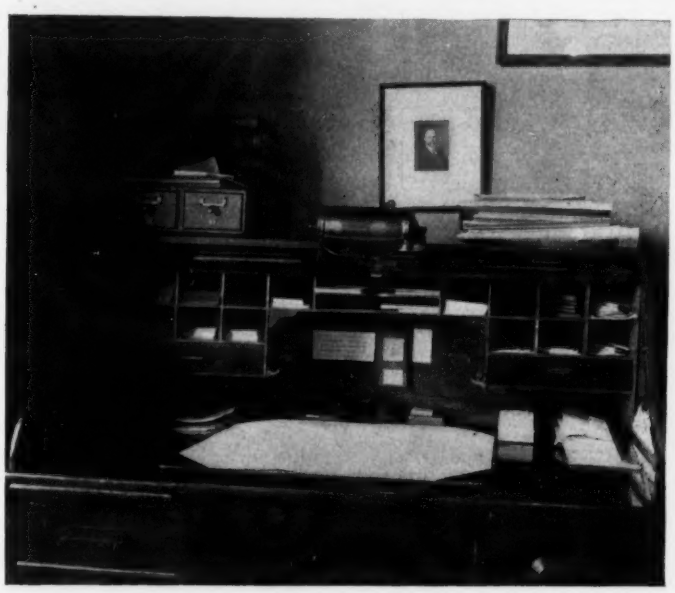


FIG. 1.—POOR ARRANGEMENT OF DESK LAMP.

FIG. 3.—DESK PORTABLE IN RIGHT POSITION.

3. The light should be free from streaks or striations.

4. Too great intensity of light should be avoided. An intensity of from 3 to 5 candle-feet (normal) on the top of the desk is about right.

5. The light should be steady—in other words, should not be swinging; and if it is electric light the voltage regulation must be good.

Before considering the illustrations which follow, it may be well to call attention to a misapprehension which seems to have existed in some quarters as to the illustrations of examples of lighting in previous articles in these columns by the authors. Some readers seem to have received the impression that the photographs from which the illustrations were made were taken by the artificial light in the room in order to show the illumination. As a matter of fact, it would be impossible, as any photographer knows, to take such photographs by artificial light. The photographs were taken by daylight for the purpose of showing the location and arrangement of fixtures and glassware and not to show the illumination from the lamps themselves.

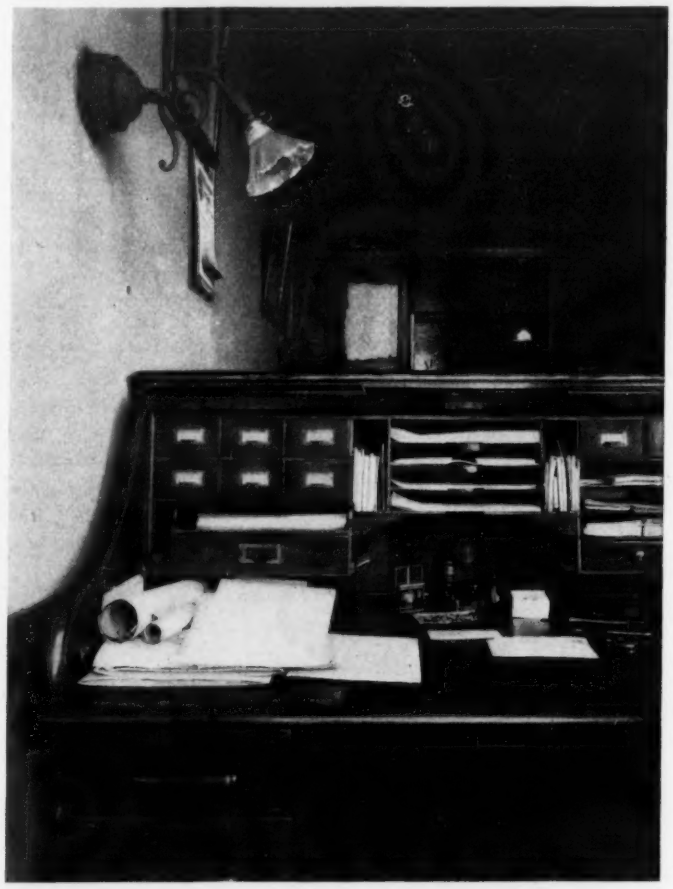


FIG. 2.—PROPER POSITION OF LAMP FOR DESK LIGHTING.

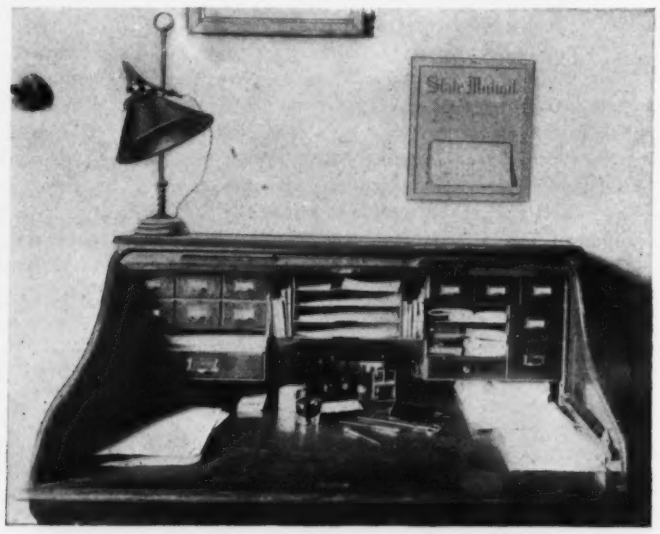


FIG. 4.—POSITION OF STANDARD PORTABLE DESK LAMP.

A very common and popular method of lighting desks is by the use of a cylindrical desk shade at the center of the desk, as in Fig. 1. While this arrangement is fairly satisfactory, it is capable of much improvement. The lamp is in such a position that when the user of the desk attempts to read or write with a paper directly in the middle of the desk in front of him, there is

FIG. 5.—BAD POSITION FOR DESK LAMP.

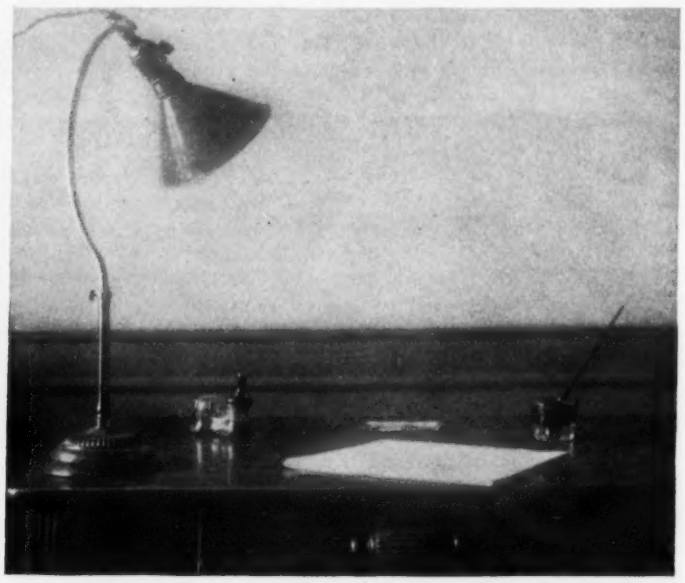


FIG. 6.—PROPER POSITION OF LAMP ON FLAT-TOP DESK.

so much reflection or glare from the paper as to make it not only very trying to the eyes, but difficult and sometimes impossible to read. The work must usually be shifted either to one side or the other of the desk or the lamp must be shifted. The cylindrical desk shade shown in Fig. 1 does not throw a light nearly as strong as the parabolic aluminum reflector shown later in Figs. 7 and 8, as was pointed out in previous articles published in these columns.

Fig. 2 shows one of the most satisfactory, comfortable and efficient ways of desk lighting. Here the lamp is located on the bracket at the left-hand end of the desk. The bracket is equipped with a concentrating type of prismatic glass reflector. The user of a desk so lighted experiences practically no discomfort from the glare or regular reflection from the paper, while at the same time the desk is well lighted over its entire surface. The comfort of working at such a desk as compared with those lighted by many of the common methods is remarkable. The light is high enough above the user of the desk to be out of the line of ordinary vision, so that as far as desk use is concerned it is not absolutely necessary to equip the lamp with a frosted bulb for diffusing purposes. It is advisable so to equip it, however, on account of other occupants of the room, and because the light is so well diffused by the frosting that less glare is received from the work on the desk and it is consequently an easier light to work by. The lamp should be so placed that a plumb line dropped from the lamp to the top of the desk would strike about one foot from the front edge of the desk.

The bracket in Fig. 2 would give good results with any one of several other types of concentrating reflectors, including the opal cone, "X-ray" desk shade, McFadden desk shade, McCreary desk shade and frosted aluminum cone reflector. The two first should be used with frosted bulb lamps.

The same relative location of the lamp shown in Fig. 2 can be obtained with portable desk lights, as, for example, in Fig. 3, which shows a fixture of special design. This fixture, however, does not bring the lamp as far out toward the front edge of the desk as it should to give the best results. It should overhang far enough to bring it directly above a point one foot from the front edge of the desk, as before explained.

FIGS. 7 AND 8.—IMPROPER AND PROPER POSITIONS OF PORTABLE DESK LAMP.

Fig. 4 shows the same position of the lamp as in Fig. 2, but with an ordinary portable desk fixture equipped with a green opal desk shade. The light obtained on the desk with the green opal shade in Fig. 4 will not be as great as with the prismatic glass reflectors in Figs. 2 and 3. It will furthermore always be neces-

sary to eliminate the streaks which accompany the light from the opal desk shade by using a frosted bulb lamp.

Fig. 5 shows a misdirected attempt to light a desk which is bad from every standpoint. A powerful prismatic reflector mounted on a bracket above the middle of the desk throws the light down at such an angle that the occupant gets an enormous amount of glare from the paper by working anywhere near the middle of the desk, and receives the full glare of the light from the reflector whenever he raises his eyes. Furthermore, much of the light does not fall on the desk, but on the person who is using it. This could be easily rectified by simply turning the desk around as shown in Fig. 2.

Fig. 6 shows the proper position for a lamp on a flat-top desk or table. The stand should be placed near the left-hand elbow and an opaque shade should be used, pointed at such an angle that the light will fall on the work without striking the eyes of

FIG. 9.—FAIR DESK ILLUMINATION.

the user. This position can manifestly be obtained with several other types of portable desk lamps. Fig. 6 was taken merely to show the proper position.

Fig. 7 shows an excellent desk fixture misused. In Fig. 7 the desk is small, and in placing the lamp in the parabolic aluminum reflector in the position shown it is entirely too close to the paper. The intense light is concentrated on the paper at one point, the edges of the desk being in darkness; and there is much glare or reflection from the paper under the reflector so that the only portion of the desk which is well lighted can hardly be used without ruining the eyes. On a low top desk such as this the proper position for such a fixture is as shown in Fig. 8. Here the lamp is virtually placed in the same relative position to the user as in Figs. 2 and 3. The fixture is a very useful one because it can be adjusted in so many different positions. The parabolic aluminum frosted finish reflector with which it is equipped is more efficient than the cylindrical desk shade shown in Fig. 1. A frosted bulb should be used with it.

With opaque desk shades such as shown in Figs. 1, 4, 6, 7 and 8, other light should always be used in the room to supplement the desk light, as otherwise there will be too much strain on the eye in changing frequently from the brightly lighted top of the desk to the dark room. With opal or glass reflectors, as in Figs. 2 and 3, enough light escapes through the reflector for considerable general lighting of the room, so that other lighting of the room may not be necessary.

Fig. 9 shows a method by which as a makeshift a lamp on an ordinary drop cord can be made into a fairly satisfactory desk light. The lamp should hang over the left-hand end of the desk. By looping a short piece of cord around the thumbscrew on the shade holder and tying the other end around the lamp cord, as indicated, the lamp can be given the proper angle to light the entire surface of the desk.

## Papers and Discussions Before the Iowa Electrical Association.

Below are given abstracts of the papers presented at the recent meeting of the Iowa Electrical Association and abstracts of the discussion on the same. The first paper on the programme was a report on progress by Mr. James R. Cravath, an abstract of which follows:

REPORT ON PROGRESS.

The most notable development in the central station field during the past year was stated to be the increasing amount of attention given to means for expanding and increasing central station business, great activity having been manifested in the organization of departments or methods for getting new business. Observation of what a few of the more progressive companies are doing, as compared with unprogressive companies, indicates great possibilities of future development on lines which have been well tried by the former; and the central station business as a whole promises within the next few years through a proper awakening among central station companies an increase equalled by few other lines of business of equal stability.

One of the most interesting developments during the past year has been the increasing number of small single-phase high-tension lines for supplying a number of villages in a district from a central station located in one of the larger towns. Activity in the building of such lines seem to have been greatest in Illinois, where conditions are favorable to them.

Another important development of the year is the increasing attention given by central station companies and others to the efficient use of light, or in other words, to illuminating engineering. There appears to be at the present time far greater opportunity to increase the efficiency of electric lighting in a manner which will enable it to better compete with other illuminants by attention to the proper placing of lights and their equipment with the proper globes and reflectors than by an increase in the efficiency of the lamps themselves. A company can afford to give considerable attention to seeing that its customers are provided with electric light so installed that it will be a credit to the business. Some of the larger central station companies are beginning to fully realize that as a matter of self-defense the efficient use of electric light is something to which the central station must give attention, if it is to compete successfully with other illuminants and retain the growth all are hoping for. The formation recently of the Illuminating Engineering Society with a large membership shows the interest being taken in this subject.

For companies having alternating current supply in down-town districts and where a decent voltage regulation is maintained, the Nernst lamp has during the past year still further proved its efficacy as a competitor of gas and gasolene lamps. On account of its better downward distribution of light, the Nernst lamp is able to make a much better showing in store lighting than the alternating current arc of similar capacity.

The Cooper-Hewitt mercury vapor arc lamp is making rapid progress for the lighting of factories and all kinds of workshops where its color is not objectionable. Of its high efficiency and the superior diffused quality of illumination it gives there can be no question. Practically the only objection to it is its color, which is somewhat a matter of personal taste and usually ceases to be an objection after it has been used a few days.

Another new illuminant which has been heralded the past few months is the flaming or luminous arc, alongside of which, as one writer expressed it, the ordinary arc lamp appears about as luminous as a tallow candle. The present cost of carbons and the daily trimming on the flaming arc partially, if not entirely, counterbalance the increase in efficiency, while the fumes given off unsuits the lamp to some interior lighting. The place that the flaming arc will occupy in the art is yet uncertain on account of these conditions.

Referring to the use of arc lamps with smaller carbons, it is stated that the Chicago Edison Company now has about 1,500 direct-current enclosed arc lamps using carbons of 5/16-in. diameter. On a 3.5-amp. arc lamp, the increase in efficiency by

using 5/16 instead of ½-in. carbons is over 50 per cent. Alternating-current arc lamps with small carbons are also being put out in Chicago with considerable improvement in efficiency, although no tests of these are yet available. There is not only a gain in efficiency, but the light is much steadier and whiter than with large carbons which allow the arc to wander and which give an excess of violet rays.

While some central station managers have been skeptical as to the possibilities of electric heating, the fact remains that flat irons are being introduced in such large quantities in a number of places that there is now no question as to their importance to the central station business. While the cost of their operation is somewhat higher than that of other irons, they are so far superior that once properly introduced in a house the chances are ten to one they will never come out. Where indifferent success has been met in the introduction of electric flat irons as manufactured to-day it can be due only to failure to introduce them in the right way. Either the central station men themselves do not understand the merits of what they are offering and thus cannot talk electric irons intelligently, or in placing them out on trial they do not take pains to see that customers are properly equipped to use the iron conveniently. It is usually cheaper to place a lot of irons on trial among customers than to spend a lot of money or time soliciting to persuade them to buy something with which they are not familiar. After trial, a certain per cent will come back to the company, but these can be placed elsewhere so that there is no loss in the long run. The electric iron business bids fair to double the present revenue from residence customers. For that reason it is a most desirable class of business to push. It requires no additional investment in transformers and lines since it is non-peak load. Other heating devices are also worth pushing, but the electric iron is undoubtedly the most promising thing of the immediate future because it is a good revenue producer, is low in first cost and reasonable in cost of operation.

Another class of non-peak load which is worth some attention is the motor-driven ice machine business. Motor-driven refrigerating ice machines at ordinary rates can make a decided saving as against refrigeration by natural ice. The principal obstacle to be overcome in getting meat markets, hotels, restaurants and the like to put in ice machines is the high first cost of the ice machine as compared to an ice-box. The saving over ice is, however, enough to fully warrant the investment if the customer has the necessary capital to make the change.

Gratifying progress has been made in the design of single-phase motors so that companies operating single-phase distribution systems exclusively (of which there are many) can now offer to customers motor service of any kind that is available on direct current with the exception of variable speed machine tool and printing press motors. During the last year hoisting motors for elevator and crane service and the like have been developed for single-phase 60-cycle circuits.

There is an increasing realization of the fact that residence lighting, although giving a small income per customer, is a very desirable class of load for a company if it can only develop this business so that it is not too scattered. Smaller residences are, on the whole, a better class of customers than large ones. The aim should be to get a large number of these smaller residence customers connected. With a reasonable number of customers per block the distribution charges can be kept at a point where there is a profit in this business. Although the scheme of wiring residences on the installment plan has never been tried extensively, some such plan may be worth pushing in some towns for the sake of getting hold of this class of business.

Centrifugal pumps for use in pumping high heads have been in common use on the Pacific Coast for many years for irrigation and mine pumping direct connected to electric motors. This practice is now spreading eastward, and eastern manufacturers are also taking up the direct connected centrifugal pump. For some classes of city water pumping this puts in the hands of central station companies which are endavoring to secure such contracts a very efficient and easy to maintain form of apparatus for carrying on this work. It is, of course, not suited to deep well pumping.

In discussing this report, Mr. D. F. McGee, of Red Oak, asked for figures on the cost of maintaining electric flatirons and other heating devices.

Mr. A. W. Zahm said that the five tailoring establishments of Mason City which used electric tailoring irons spent altogether $5 per year in maintenance and renewals. These irons were in service so much of the time and were so large that their maintenance would naturally be high. In the case of one type of household iron, the manufacturers guaranteed them against burn-outs.

Mr. L. D. Mathes, of Dubuque, said that of 160 household irons on his circuits only one burn-out had been recorded. It was necessary to coach carefully customers turning current on and off irons, not to use the ordinary key socket. While the short-circuiting of a socket in breaking a 500-watt iron circuit might not cause any serious damage, it would scare the user and create a prejudice against the iron, especially if the user was a servant girl. He thought the maintenance on electric household irons with the manufacturers' guarantee could be counted on as practically nothing.

Mr. Cravath said that a central station company could safely leave household iron maintenance out of consideration with the present manufacturers' guarantees.

### FACTS AND FACTORS.

Mr. D. F. McGee, of Red Oak, chairman of the Committee on Facts and Factors, reported having sent out report blanks with a view to obtaining data. The members had not responded in a way which would enable him to make a report. Mr. Zahm explained that many companies did not have the data called for by the reports and urged such companies to put in the necessary instruments to find out their switchboard costs.

Mr. McGee showed the form of report which must be made to the State commission in Massachusetts. As a commission of this kind was being advocated by some Iowa central station men as the best way of handling the rate regulation question, it would be well for members to look over the Massachusetts report form which was much more elaborate than the committee on Facts and Factors had asked. If a commission is to be created in Iowa in the future companies will have to prepare to make such reports.

Mr. Gus Lundgren, of Cherokee, urged the members to buy recording switchboard meters, water meters and scales to find out where they stood. Mr. George S. Carson cited a case under his notice where a great saving had been made by a little use of such instruments. It is notable that large syndicates, in buying a property, ask what the gross earnings are rather than the net earnings. Such syndicates with their engineering talent know what the operating expenses ought to be and know definitely how to go to work to reduce them to the proper figure. Mr. Lundgren cited a case where an engine which was thought to be all right was found upon test to take 63 lbs. of steam per indicated hp-hour. It was decided to continue the committee another year, in the hope that more data could be obtained upon the next trial.

### WAYS AND MEANS OF INCREASING BUSINESS IN TOWNS UNDER FIVE THOUSAND.

Mr. O. E. Brownell, of Lake City, read a short, pithy paper on this subject. He explained at the outset that he was operating his station under a lease and hence was somewhat handicapped as compared with a company which could make extensions and improvements without consulting the owner. He placed much stress on uninterrupted service as a foundation for increasing business since new business cannot be secured if the service is not satisfactory. In this connection prompt, courteous attention should be given to local troubles on customers' fixtures or wiring. Customers must be impressed with the stability and reliability of your service. In connection with storage of coal in anticipation of the recent coal strike, he had watched the railroad companies, whose actions were good indicators of what might be expected. When he found they were laying in a three months' supply, he went one better and laid in four months' supply. When the strike began it was a good advertisement for the com-

pany's service and management to be able to assure both electric light customers and the city (for which he did water pumping) that he had four months' coal supply on hand.

He had found it well to get the interest of certain local merchants in electrical matters, that these merchants might seek to have for display in their stores as curiosities some of the most recent electrical appliances, thus drawing people to the store to see these and incidentally, advertising electric central station service. There are usually some such merchants in every town. For example, by getting on friendly terms with a druggist his natural interest in scientific subjects will induce him to get posted on electrical developments and he will become a good talker for electric service. Mr. Brownell further suggested that a good thing to counteract some of the municipal ownership and anti-corporation sentiment of the present time is to advertise well by talk around the town some of the heavy expenses of the company for coal and other items, which items of course in a small town look very large. With the expenses of the business better understood, there will not be so much complaint about rates or objection to private ownership. He urged companies to aid customers in keeping their bills down by seeing that they are equipped to utilize electric light economically. For lighting living rooms he had been generally advocating ceiling lamps for general lighting of the room with brackets for reading lights. He was among the earliest to take hold of and push prismatic glass reflectors. These are some of the methods he had used to increase his business 30 per cent in the past 20 months in a town of 2,350 population.

Mr. Carson, in discussing this paper, thought Mr. Brownell made a good point in trying to avoid overloading a customer with electric light bills. In most small towns the majority of people were of necessity forced to economize. Anything which can be done to help the customer along and keep bills so that he does not consider them a burden will make friends for the company in the community.

Mr. McGee, speaking about advertising, did not favor publications sent out indiscriminately to customers which might educate them to something they ought not to have. He thought in a small town the manager should know best what a customer ought to have. If the customer is sent literature advertising devices which look well on paper, but are not suited to his conditions, he is made dissatisfied, which means trouble for the company.

### ENGINE LUBRICATION.

A paper was on the programme on the effect of boiler compounds on engine lubrication, but as the author of the paper was not present the subject was dismissed with a short discussion.

Mr. W. J. Greene, of Cedar Rapids, had used soda ash in some badly scaled boilers some time ago with some resulting trouble in cylinder lubrication.

President Burt asked for figures on the ratio of cost of cylinder oil to coal bill. Mr. J. A. Innes, of Eagle Grove, reported cylinder oil as costing one per cent of the coal bill. He operates a heating plant. F. L. White, of Traer, reported one-half of one per cent. He operates a heating plant. Mr. McGee, of Red Oak, who operates also a heating plant, reported one and one-half per cent. Mr. Greene, of Cedar Rapids, who operates a heating plant, reported one per cent.

### CONDENSING PLANTS IN SMALL STATIONS.

Mr. W. A. Mall, of Belle Plains, described conditions and results in his plant where an engine of 115 hp was equipped five years ago with a condenser. The expense for equipment, including necessary oil separator and alterations in the building, was $2,000. Cooling water was obtained from a constantly flowing artesian well. A surface condenser was installed so that the water of condensation could be used in the boilers, as much trouble had been experienced with scale. From 23 to 28 in. vacuum was obtained. The boilers became heavily scaled at first and for some time the scale would not come off, but was finally started by the use of a boiler compound. The saving in fuel was $300 the first year. Since then the business had been increased 25 per cent and the price of coal increased 15 per cent, with an increase of only 10 per cent in the fuel bill. An inquiry by the president following this paper revealed the fact that only four condensing stations were represented in the audience.

Mr. A. W. Zahm, Mason City, said that his company was arranging to use the hot water heater of the Yaryan heating system as a surface condenser so that the station could be run condensing during the summer time. The circulating pump of the hot water heating system will become the circulating pump of the condenser in the summer.

Mr. J. G. Boyd said that at Blair, Neb., a saving of fuel 22 per cent had been made the first year by the use of a condenser. Attention was called by Chairman Burt to the fact that the condenser, besides giving increased economy, increases the capacity of the engine, a fact sometimes lost sight of in figuring condenser advantages.

### THE EFFECT OF A DAY LOAD ON STATION ECONOMY.

Mr. J. P. Jones, of Cedar Falls, read a paper on this subject, giving figures on the cost of operation of the Cedar Falls station several years ago, showing what the effect of operating it during daylight hours would have been at that time. In figuring the cost of operation during the day the coal used in banking the fires in the morning and in getting up steam in the evening where no day service is given must be credited. In this station he figured 175 lb. of coal for banking fires and 250 lb. for steaming up. This 425 lb. of coal would operate the station about a quarter of the time during the day. He figured the cost of day operation in this plant after making proper deductions and credits, would be $103.50 per month, divided as follows: Coal, $51; oil and waste, $2.50; engineer, $50. The income to be gained from daylight operation of this plant, he figured considerably less than this, but with the increase in business in the course of a few years, the day service could be made to pay for itself, and in the long run would, probably, be worth what it cost. The Cedar Falls station is not operated at the present time, having been changed to a sub-station supplied from Waterloo.

Mr. W. J. Greene, of Cedar Rapids, read a short paper on the same subject, which gave figures on Cedar Rapids conditions 15 years ago, at the time day service was begun. These figures showed a great increase in the net earnings as a result of the day service, Cedar Rapids being a city of over 20,000 population.

Mr. D. F. McGee, of Red Oak, said that 40 per cent of the receipts from electric business in his town of 5,000 inhabitants were from power business. The first year that day service was given, but little power was sold. He had to work a long time on most customers to get them to change to electric power. One common misapprehension among power users was that they thought they needed a much larger motor than was actually necessary. For example: A blacksmith in his town had a 25-hp engine and boiler which was fired up once a week to clean up what work the blacksmith had on hand. After a long time he was persuaded to put in an electric motor so that he could turn out work requiring power whenever it came in. It was found that a 5-hp motor was ample for his work. Overestimates of this kind were the rule rather than the exception.

Mr. Carson thought that towns of 3,000 inhabitants and over ought to support 24-hour service. Mr. White advocated storage batteries for day service in small direct-current plants.

### A DISTRIBUTION SYSTEM.

Mr. J. A. Innes, of Eagle Grove, read a paper on the distribution system at Eagle Grove. Seventy per cent of his company's income is from residences, and he has one meter for every ten inhabitants. The original distribution system was two-wire direct current, which had been retained in the down-town districts. The direct-current mains in the residence districts were changed to secondary mains fed from transformers. The street lighting is supplied on a constant-potential system from four transformers, located at centers of distribution. A common primary main supplies both residence and street lighting transformers on one side of the circuit, separate mains being used on the other side of the circuit so that the street lights can be switched off independently. One side of both house and street lighting secondary circuits is grounded, the same grounded main being used for

both. The other side is provided with lightning arresters. A double-pole lightning arrester is used with one pole connected to the non-grounded side of the residence lighting secondary mains and the other pole connected to the non-grounded street lighting secondary main. The grounded secondary main supplies both residences and street lamps, being common to the two systems. He believed grounded secondary circuits reduce lightning disturbances.

### CARE AND MAINTENANCE OF METERS.

Mr. A. W. Zahm, of Mason City, read a paper on the above subject. In urging the importance of meter testing at regular intervals to avoid loss through meters which failed to record all the energy passing through them, he cited the case of a municipal plant which had never had its meters overhauled and which upon being tested gave some "fearful and wonderful" results. But a small percentage of the energy being delivered to customers was paid for on account of slow meters. He thought it a good plan for small central station companies to employ the service of some of the regular meter-testing companies, which for a fixed sum will go over the company's entire equipment of customers' meters, testing them for accuracy and making repairs, adjustments and cleaning whenever necessary. Such companies are better equipped for this work than the small central station company. Where this is done he thought it well to give publicity to the fact that the company was having its meters tested by an outside, disinterested concern which makes meter testing its business. A record should be kept of all meters owned by a company from the time they are received from the factory. This record should include manufacturer's number, operating company's number, date of purchase, dates of installation in various locations, dates of tests and notes on work done upon the meter.

Messrs. Innes and Lundgren both spoke on the advantages of purchasing a master watt-hour meter which can be put in circuit with watt-hour meters and indicating instruments to calibrate them. Upon taking a vote it was found that a large percentage of the companies represented test new meters when received from the factory.

### UP-TO-DATE LIGHTNING PROTECTION.

Mr. W. P. Casper, of the Garton-Daniels Company, read a paper devoted principally to that company's type of arrester, and presented a chart showing its construction and method of operation. He pointed out the fact that since lightning discharges are oscillatory in character, and hence greatly influenced by the inductance of long lines, frequent opportunities to discharge to earth should be offered if the insulation of lines and apparatuses is not to be punctured. Unless arresters are installed at frequent enough intervals to take care of these discharges, it is only to be expected that arresters will fail to accomplish their purposes. He urged the importance of good grounds for lightning arresters.

Mr. George S. Carson told of an extremely severe lightning condition on the line supplying Iowa City from a water power plant three miles distant. Although lightning arresters had been installed in as great numbers as recommended by the manufacturers, apparatus continued to be lost until choke coils were used in the line. Barbed wires were also placed about 18 in. above the highest conductor. The choke coils consisted of 18-in. porcelain tubes wound with wire and having an iron rod inserted in the tube. To the ends of the iron rod insulating attachments to the line were made so that the choke coil was inserted in the line like a turnbuckle. He believed the choke coils had been largely responsible for their freedom from lightning troubles, as there had been no burn-outs since the coils were inserted, the number of arresters remaining same as before.

President Burt told of inserting choke coils 6 in. in diameter of No. 0 wire in a 10,000-volt transmission line. The coil was about 2½ ft. long. There had been no trouble on this line since the coils were inserted. Two 75-kw transformers had been lost previously.

### GROUNDING SECONDARY CIRCUITS.

Two papers were read advocating strongly the grounding of secondary circuits of transformers. One paper by Mr. H. G. Gorr, superintendent of electric lighting of the Union Electric Company, of Dubuque, was read by the secretary in the absence of the author. The paper pointed out that crosses between high-tension and low-tension secondary circuits are unavoidable in practical operation. High-tension wires may fall over low-tension wires and transformers may become defective through lightning discharges so that there is a leak from primary to secondary. Furthermore, there are frequent discharges on non-grounded circuits during thunderstorms from the live conductor to grounded fixtures or gas pipes. All these conditions are dangerous to life and property. The grounding of secondary circuits was urged emphatically as a positive relief from these dangers. The recent attempt to have grounding made compulsory in the National Electrical Code was mentioned as further supporting the author's position.

Mr. Thomas Sloss, of Cedar Rapids, read a paper also advocating the grounding of secondaries. Every transformer is now grounded at Cedar Rapids. One argument had been made against grounding, namely the possible failure of watt-hour meters to properly register if placed on the grounded side of a circuit which was grounded at the transformers and also in the building. Out of 1,400 watt-hour meters at Cedar Rapids, there had been almost no trouble from this source. On the other hand, transformer troubles and burn-outs had apparently been almost eliminated by grounding. The grounding was accomplished by connecting one side of the circuit to a copper-tinned plate 6 ft. square buried in the ground in permanent moisture. Eight bushels of charcoal are put around the plate. The cost of such a ground is about $10.

President Burt remarked that it was disquieting for those operating with non-grounded circuits to consider this subject because of the constant possibilities for fatal accidents on the low-tension incandescent circuits where these circuits were not grounded. One never could tell at what moment such crosses between high and low-tension wires might occur. At the present time if it could be shown in court that a company had not taken due precautions to ground its secondary circuits, it could be held absolutely liable for damages to persons or property due to the presence of abnormal voltage on low-tension circuits.

Mr. Mathes told of a case now in the Iowa courts in which the plaintiff maintained as a basis for a damage suit that the company had failed to ground its secondary circuit and as a result a man in contact with a good ground had touched a lamp socket with fatal results. The company's contention was that the secondary circuit supplying that lamp socket was grounded and that the man who was killed had been suffering from heart disease for some time, having been treated medically for the same. It was believed that if thoroughly established by the evidence that the transformer secondary was grounded the company could not be held liable on account of negligence. The decision in this case would be looked for with interest.

Mr. Cravath described a method of grounding transformers adopted by the Commonwealth Electric Company in Chicago as being fairly as effective and cheaper than the ground plate mentioned in the National Electrical Code. This method consists in driving a galvanized-iron pipe about 10 ft. into the ground to permanent moisture and soldering the ground wire to the upper end of the pipe. The cost of grounding small transformers with a ground plate might deter some companies from doing it. This iron pipe ground offered a fairly efficient substitute at considerably less cost.

Some question was raised as to the efficiency of iron pipe grounds for lightning arresters on the theory that they would offer too much inductance in the path of a discharge.

Mr. McGee, of Red Oak, gave his method of grounding, which is to use a 1¼-in. galvanized-iron pipe, but instead of driving this pipe down as is the practice of many, he bores a hole down to water with a 2-in. carpenter's auger mounted on the end of a piece of pipe. By drilling an auger hole one can tell when water has been reached whereas if an iron pipe be driven down there is no telling the condition of the soil at the bottom.

Mr. Zahm cited the experience of a certain trolley road which would indicate that grounding to track rails is not sufficient and that ground plates should be used for all arresters.

Mr. Greene said that grounding of secondaries removes a great

load of anxiety from the mind of the manager who has had a little experience with fatal or severe accidents by shocks from non-grounded secondaries. His company had two such accidents a few years ago and after that were in fear and trembling, especially after thunderstorms, lest there should be another one. They only rested easy after all transformers were grounded.

PRACTICAL EXPERIENCES WITH STEAM TURBINES.

Wednesday evening an informal session was held at which the subject, "Some Practical Experiences with Steam Turbines," was taken up. This discussion was opened by a paper from C. E. Stanton, chief engineer of the Union Electric Company's plant at Dubuque, Iowa. The greater part of Mr. Stanton's paper was given to describing precautions found advisable in maintaining the step-bearing at the bottom of the Curtis turbine shaft upon which the weight of all the revolving parts rests. This weight is carried in the step-bearing by a film of water which is forced through the bearing under high pressure. Step-bearing water at Dubuque is now passed through a Jewel water filter to insure its purity. Trouble having been experienced with the packing from pumps coming loose when old and plugging up the strainer in the step-bearing piping, it was found advisable to keep a record of the number of days packing was in service and to renew this packing after a certain number of days' service, before it would start to go to pieces and stop up the strainers.

The hydraulic accumulator is a weighted hydraulic piston designed to supply water to the step-bearing for a few moments in case the step-bearing pump should stop. This accumulator is tested every 24 hours to prevent it from rusting fast at one point and sticking. This testing is done by lowering and raising the accumulator piston 4 or 5 ft. every day. The construction of the accumulator is such that there is opportunity, in the language of the author, for "an elegant rust joint" to form around the piston if it is left long enough in one position. It is well to have a signal such as a whistle or gong, which will sound as soon as the accumulator begins to lower, thus giving notice that the water supply from the step-bearing pumps is failing and giving the attendant time to shut down the turbine or get another pump into operation.

The step-bearing should be carefully inspected before assembling to see that surfaces are perfectly smooth and free from burrs or dirt which would cause friction. In assembling it is important to see that the step-plate fits perfectly square and that nothing like metal chips or dirt is present to prevent it from seating itself squarely.

The turbine is governed by opening a greater or less number of valves. If it is operated on less than a certain load for a number of weeks, as may sometimes occur, some of the valves will not have occasion to open in that length of time, so that when an unusual demand comes on the turbine calling for the opening of these extra valves they will stick if they have not been moved by opening occasionally. The governing of the turbine is so excellent that at Dubuque lighting and railway loads are carried on the same bus-bars.

With superheated steam it was found that metal valve packing melted out, resulting in the presence of metal chips which were decidedly undesirable around a steam turbine system. Since this trouble with metal packing, asbestos packing has been used where there is superheated steam. The general conclusions of the paper were favorable to the steam turbine as against the reciprocating engines.

At the close of Mr. Stanton's paper Mr. Niels Christensen, chief engineer of the Citizens' Gas & Electric Company, of Waterloo, Iowa, was given the floor to answer any questions put to him regarding his experiences in operating the 500-kw Curtis steam turbine recently placed in his company's power house. His company did not install an accumulator to maintain step-bearing pressure. It has pumps in duplicate for this purpose. He did not consider accumulators very good insurance against step-bearing failures since two step-bearings had been burned out at Dubuque for reasons given in the previous paper. It requires about four minutes to get the turbine up to speed. The turbine will run about 50 minutes after the steam has been shut off. This 500-kw turbine will give 400 kw running non-condensing. He thinks most turbine troubles are due to the use of superheated steam. Superheated steam was not used at Waterloo on account of the added complications, although probably about 10 per cent increase in economy could have been secured by its use. The economy is about the same as that of a compound condensing engine. The advantages are mainly those of better speed regulation, saving in space and pure boiler feed water.

Mr. Mathes, of Dubuque, said that another point in favor of the turbine was that its overload capacity makes possible a low investment per kilowatt of peak load to be carried. He cited some enormous overloads carried by the 5,000-kw turbines in the Commonwealth Electric Company's plant in Chicago.

At the request of President Burt, who is superintendent of the Citizens' Gas & Electric Company, of Waterloo, Mr. Christensen then read a report of the official test on turbine and engines in the Waterloo station. An abstract of this report will appear in these columns next week. The discussion then drifted into the action of centrifugal circulating condenser pumps and it appeared that some attempts to get balanced column syphon effects and make a long column of descending water to balance a column of ascending water had been partial failures with such pumps.

TECHNICAL MEN IN CENTRAL STATIONS.

Prof. George D. Shepardson read a paper entitled "Technical Men as Dividend Earners." He said the subject had been suggested to him by two recent incidents. One was a proposition that young engineers engage with central station companies under a contract by which their salary would be proportional to the dividends paid. Some central station men had laughed at this proposition on the ground that many central stations paid no dividends whatever. The other incident which induced him to write on this subject was a letter received from the editor of a prominent electrical paper reviewing the conditions of the central station business and the need for technical men in it. He then read from this letter at length. It said that previous to 1902 there had been an increase in the incandescent lamp output of approximately 20 per cent per year. This rate of increase had been falling off steadily since that time, which indicated that the central station business was hardly in a satisfactory state. It is to the technical man that we must look to change this condition of affairs, not so much on account of his technical knowledge as on account of his trained mind, which gives him the advantage over the non-technical in grappling with new problems and analyzing results. A technical man, after he has passed through a probationary period in getting acquainted with the practical part of the business, should be of great value to central station companies.

After reading this letter, Prof. Shepardson analyzed the alumni list of a Western university's electrical engineering department (presumably University of Minnesota). He found that 27 per cent of the graduates since the beginning of the department were to be found in central station work. This figure, however, applies to the whole period rather than to recent years. In the past four years 34 per cent of the graduates have been taken by manufacturing companies, 24 per cent by telephone companies and 24 by lighting and railway companies. Of the latter, half were with one company, which was a large operating syndicate. This year he had received applications from manufacturers for 128 per cent of the year's graduating class. From operating companies he had received applications for only 25 per cent. From these figures he was forced to the conclusion that manufacturers were appreciating the value of technical men more than the operating companies. Outside of the large syndicates less than 2 per cent of the recent graduates were with the smaller operating companies, leaving out of account a few who owned stock in operating companies. The owners of large operating companies and syndicates realize that they must have technical men. These facts should be sufficiently suggestive to smaller central station companies as to the value of the technical man. He gave some reasons why central station operating work is not more attractive to technical graduates. To begin with, the salaries are low. There is likely to be a lack of appreciation of good work and there is some monotony about the work with an operating company where there is not as much contact with other bright men in the same line of work as in the larger manufacturing companies.

As to the place of the technical graduate when he enters central station work, he should be considered not as a trained engineer, but as one who needs development and practical experience. A technical man when going to a central station should not propose radical changes at first, but should rather work in gradually, demonstrating what he can do with poor apparatus already available, rather than recommending expensive changes. After he has demonstrated his ability it will be time to recommend more radical moves. He thought the small central stations should be more attractive to the young graduate than the large on account of the possibility of grasping the situation in its entirety more easily in the small station. Nevertheless, many prefer the larger stations because of the greater specialization and the chance for a long line of promotion into high salaried positions.

Prof. Shepardson then gave some practical illustrations of what technical men could do in the way of increasing economy of small central stations. One young engineer by fixing up a leaky boiler setting, cleaning flues, etc., made a 20 per cent saving in the coal bill. Another by cleaning the feed-water heater and boiler made a saving of 30 per cent in fuel. Another made a saving of 30 per cent by indicating the engine and resetting the valves. The engineer in charge knew how to use the indicator, but could not correct the trouble. Another man found a plant which was much overloaded and by fixing up leaky insulation made it possible to increase the load one-third. Another caused the reduction of the load on a station 50 per cent without reduction in the gross earnings by introducing meters. Another earned his salary several times over by getting after customers' meters, cleaning and adjusting them.

The growth of syndicate ownership makes central station work more attractive to young engineers because in such syndicates ability and enterprise are appreciated and put at their proper value. Prof. Shepardson recommended to small stations the plan of profit sharing with its employes. In conclusion he explained that he was not out hunting jobs for his boys among central station men since he already had applications for many more graduates than he could supply. He had written his paper simply to suggest that central station companies for their own good might make more use of technical men.

### DEPRECIATION OF ELECTRICAL PROPERTIES.

Prof. G. W. Bissell, of Ames, Iowa, read a paper on the depreciation of electrical properties which will be published in abstract in a later issue. It takes up the practive of several Iowa central station companies in regard to depreciation and sinking funds and also goes into the general theory of these matters.

### VARIOUS ASPECTS OF RATE REGULATION.

In view of the sentiment all over the country for rate regulation of all kinds, the programme committee arranged for a discussion of this question in all its aspects. The paper by Prof. Bissell on depreciation was intended as an introduction to the subject. The legal status of rate regulation was set forth in a very clear, concise paper by Hon. L. G. Hurd, of Dubuque, Iowa. Under Iowa laws he showed it to be well established that rates named in franchises are subject to revision by city councils if by virtue of changed conditions they are not reasonable. The whole question is whether they are reasonable, and it is upon this that the court passes when the right of a city council to establish a certain rate is made the basis of a suit. The court will refuse to sustain a rate which is proved to be below that at which a corporation can reasonably be expected to maintain good service. In case a rate-fixing body adopts a rate which is believed by the corporation to be too low, the corporation has recourse to the court which passes upon the reasonableness of the rate. If the rate is held unreasonable, the rate-fixing body can adopt another higher rate and so on until the court decides that a reasonable rate has been fixed.

Mr. George McLean, of Dubuque, Iowa, in a paper on equitable rates in relation to rate regulation, considered especially the question of the equity of the minimum bill, which is charged by many companies as a kind of readiness-to-serve charge. He then pointed out how the readiness-to-serve charge is common in many other lines of business and that it is generally accepted that such charges are entirely just. The argument that a readiness-to-serve charge requires a customer to pay for something which he does not receive will not hold any more in connection in the electric lighting business than in any other. He discussed two kinds of franchises under Iowa laws. Under one it is agreed that the city council shall have the power to regulate rates at certain specified intervals during the life of the franchise. Under another with the absence of specification this right can be asserted at any time. The first plan has the advantage of giving the company security against rate regulation between intervals, but rather invites the probability of attempts at rate regulation at the intervals specified in the franchise. He advocated, as being probably the most satisfactory plan, a form of franchise whereby the company would share its profits with the city, thus making the interests of the city and company identical, and making the amount of payment to the city dependent entirely upon the dividends earned. In case the surplus earned is paid back into the property instead of being paid in dividends, the benefits accrue to the city in better service and extension of lines into new territory. Rate regulation then becomes entirely automatic. By taking the public into partnership municipal ownership and rate regulation agitation would be entirely prevented.

Congressman M. J. Wade, of Iowa City, gave an address on the political status of rate regulation. He believed that demands for municipal ownership, rate regulation and the like have arisen from abuses or believed abuses by corporations. Corporations like individuals suffer through the misdeeds of a few, and because of great abuses for which some corporations have been responsible in the past. Of all things which have caused the most prejudice against corporations he thought the practice of stock watering had done the most. People do not like to be hoodwinked. They do not object to large dividends being paid by the corporation so much as to an attempt to cover up actual profits by the issuing of watered stock. Then again the practice of many corporations in bribing public officials was responsible for much prejudice against them. Here again it is a case where the many suffered for the few and where the many fair and honest companies were injured in reputation by the practice of a few bad ones.

We cannot shut our eyes to the fact that the people are demanding regulation of rates. He suggested that the way to prevent unjust legislation is for corporation officers to get down among the people, get acquainted with them and educate them to the difficulties of the public service business. The public will demand nothing more than it believes to be reasonable and fair.

### ADVERTISING METHODS.

Mr. Frank B. Rae, Jr., who was on the programme for a paper on modern advertising methods, could not attend the convention, but his paper was read at the last session. Advertising, he said, is the talk of the hour among central station men. It is being discussed everywhere. Where will it all end? He thought it would end in this way, that the central station business would become just as other lines of business. Central station product will be sold by advertising and solicitation just as the products of other lines of business where these methods have become well established.

In discussing this paper Mr. F. W. Kelley, of Davenport, was called upon as one who had made considerable use of advertising and solicitors. He said that his company's solicitors had been working mainly on the gas business, but had also done good work in the electrical department. On account of the competition in his town they had used considerable advertising space in the daily papers. They had found it best not to invest their money in small spaces over long periods, but that better results could be secured by taking spaces of one-half or one page. Such advertisements were the ones which helped the solicitor the most. His company recently moved its offices into a large office room on the main floor on one of the principal streets. The offices had previously been in an out-of-the-way place. The new offices were made attractive. As an illustration of what a difference the location made, he said that a chafing dish which had been on exhibition two years in the old offices was sold the second day after they moved into the new rooms. His directors had wondered how they were going to get enough out of the change to pay for the greatly

increased rent of the new offices. The profit from sales of small devices since they moved into the new offices would pay for the increased rent.

Mr. McGee, of Red Oak, believed in newspaper advertising rather than advertising by the distribution of novelties. People in his town were tired of the latter. He had secured the insertion in the local papers of recent articles telling how burglars avoid electrically-lighted houses because of the possibility of having the lights snapped on them. These few items had brought more direct returns than all the advertising they had done for some time. A lot of residences were being wired as a direct result of it, since it had struck the town at the psychological moment after a number of burglaries had been committed. He told of an amusing scheme that had been used in Lincoln, Neb., where the company advertised for a thousand dogs to be brought to the company's offices. All the small boys in town appeared at the offices the next morning with all the dogs they could find. Every dog was furnished with a blanket with an advertisement on it and they were again turned loose. It is needless to say that this created a sensation.

Mr. F. W. Kelley, of Davenport, had found it a great help in the sale of small appliances, especially sewing machines, motors and devices in which ladies are specially interested, to make it a point to sell the first machines to those who are most likely to talk about them. By carefully selecting the first list of possible customers for these things and placing the devices where they would be talked about the most, they would in time come to sell themselves.

Mr. J. R. Cravath, in further illustration of the point brought up by Mr. Kelley, recited the work done by Mr. O. K. Cole, manager of the Grinnell Electric & Heating Company. Mr. Cole had placed over 125 flatirons in that town of less than 5,000 population during the past 16 months. This was due largely to placing the first few irons where they would be best advertised by their users.

Mr. D. F. McGee said there was usually a leader in every neighborhood and that the thing to do was to concentrate all efforts upon securing that one as a customer and the others would follow. This was the secret of his success in getting residence business.

Mr. George S. Carson, of Iowa City, thought it not a good plan when putting out electric irons and cooking devices to give the customer the idea they could be operated cheaply. If put out with this idea, dissatisfaction would follow. It was not the cheapness, but the convenience of these devices that make them popular.

Prof. G. W. Bissell called attention to the advertising value of having a company's power station in good and neat condition. Slovenly looking power stations create a bad impression.

### GASOLINE VAPOR LAMPS.

A short informal discussion was started on the introduction of gasoline vapor lamps for store lighting and the amount of competition they are able to offer to electric lighting companies.

Mr. E. B. Hillman, of Quincy, Ill., and Mr. O. E. Brownell, of Lake City, Iowa, called attention to the fact that although such gasoline lamps introduced a greater fire hazard than electric lighting, insurance companies are not charging higher rates. This is an evident injustice.

Mr. J. R. Cravath stated that the bulletins issued by the Underwriters, which give the list of approved gasoline vapor lamps, plainly state that these introduce an extra fire hazard which should be recognized by increasing premiums in every case where they were used. The trouble was that the insurance companies did not live up to their own engineers' recommendations in this matter. If they did, extra rates would be charged.

Mr. George S. Carson thought the best policy toward gasoline vapor lamps was to let them alone and not stir up a feeling against the electric light companies by opposition to the gasoline lamps. It would be a case of survival of the fittest, and while some customers would be lost to gasoline lamps they would come back to electric light service in time on account of its inherent safety and convenience. The more the electric light company opposed gasoline lamps the more likely some people would be to put them in. At the same time, it might be well to take means for keeping prospective users posted as to the numerous accidents from gasoline vapor lamps, as there were plenty such.

## Collinwood, Ohio, Municipal Plant.

The municipal lighting plant of Collinwood, Ohio, is probably one of the most successful of the smaller municipal plants in that state. Without having any unusual advantages either in territory or equipment, it has had a successful career, largely through effective methods in the solicitation of business, the systematic handling of accounts and records and the application of live business methods in general.

The town lies on the outskirts of Cleveland, and it has a population of 5,500, made up largely of employees of factories in that district, so that the number of wealthy residents is comparatively small. The plant was started in 1900. The equipment consists of three 125-hp and one 150-hp tubular boilers; one 150-hp Russel engine and one 325-hp Hamilton Corliss engine belted to a jack shaft, to which are belted one 180-kw Warren 2,000-volt alternator, one 75-kw Wood 2,000-volt alternator, a Wood direct-current series arc machine and a Western Electric series arc machine, both generating 6.5 amp. at 6,000 volts.

The station adjoins the tracks of the Lake Shore & Michigan Southern Ry., with a spur for unloading fuel into covered bins. The care used in purchasing coal illustrates one of the business-

### Service Connection Card.

Service No..... Card No. .....
.....Transformer No..... .....
.....Transformer Size. .....
.....Meter No. .....
.....Meter Size .....
Street. .... .... ..... .....
Pole No..... ..... Date..... 190

No. of Lts. installed .....
Distance from Transformer. .....
.....
.....
Work done by .....

like methods of the management. Each year proposals are invited and sample lots of coal received are given practical boiler tests to ascertain the amount of water evaporated per pound of coal. A contract is awarded for the most efficient fuel, price, of course, being considered. This year Youghiogheny gas coal is used, run-of-mine, costing $1.89 delivered. The product of a certain mine is specified, and it is tested at frequent intervals to see that the quality is kept up. The consumption averages 9 lbs. per kw-hour, which is considered satisfactory in view of the equipment. An accurate record is made of the amounts delivered and the daily consumption, and balances are made each month.

The town is illuminated by 100 arc lamps. They are the Adams-Bagnall 2,000-cp (nominal) series type, using 6.5 amperes at 75 volts, and are arranged in two circuits. The town is lighted on a moonlight schedule. The cost for operating, not including interest and depreciation, was stated to have been as follows for the past four years:

| 1902 | 1903 | 1904 | 1905 |
|---|---|---|---|
| $47.94 | $48.45 | $49.47 | $47.80 |

The council paid $54 each for lamps last year, taking care of the interest, thus allowing a small profit to the plant.

The commercial load is considerably heavier on an average than the street-lighting load, the division of expenses last year based on current output being 35.5 per cent to street lighting and 64.5 per cent for commercial. The total load on the station is considerably heavier in summer than in winter, this being due to

the fact that the plant supplies Euclid Beach Park, a large pleasure resort on the lake front about a mile from the plant. This customer pays the plant about $800 per month for four months in the year, the greater portion of the consumption being between 7 p. m. and midnight. Current is sold at 4 cents per kw-hour measured on the primary side of a transformer at the park entrance. The peak load for the commercial circuit during these four months is about 260 kw, while the peak load for other months is from 100 to 120 kw.

There are about 475 customers among residences and business places. Residences are supplied at 10 cents per unit for the first 20 units per month and 8 cents thereafter. It is probable that this may be reduced to 8 cents and 5 cents, respectively. Business houses using over 100 units are supplied at 5 cents. There is a day circuit for supplying several factories having about 50 hp in motors, which are charged for at the rate of $4 per month per hp. The day circuit is handled by the smaller engine. During the winter months the large engine is sufficient to handle the evening load, while during the peak loads in the evenings of the four summer months the plant is somewhat overloaded with both engines going full; during these hours, of course, the factory load is off. All four boilers are required during the peak load in summer, while in winter three are used. It is not the practice to bank the fires in preparation for peak loads but rather all the boilers required at the peak load are used with light fires and dampers closed; then when they are needed the steam output is increased gradually. It is claimed that boiler repairs are apt to be smaller by this practice than by keeping one or more boilers banked and then firing up suddenly for a peak load.

The town covers quite a large territory and several lines have been run a distance of three miles to reach some residences of large consumers. Originally all house circuits had individual transformers, but this is being changed as rapidly as possible to the group plan, although this cannot be fully carried out owing to the scattered service. Included in the commercial circuits are about 50 alternating arcs in stores. A few Nernst lamps have been installed in residences, these being operated at 220 volts on a three-wire system. There are several electric signs and about 50 electric fans. The sale of electric flat irons and other utensils has been pushed with some success, but the management is handicapped somewhat in introducing such side lines owing to the fact that the plant is loaded up to its limit during the summer months when they are most likely to be used.

The company does all its own house wiring and sells lamps and other appliances. For this work it has an arrangement with a large electrical supply house in Cleveland which is under contract to supply as many men as are necessary at any time to do installation work; the materials, of course, being purchased from this concern. Workmen are charged for at the union scale and the plant manages to make a trifling profit on such jobs. The manager endeavors to arrange for the wiring of every new house of any size that goes up in the village whether he can secure a contract or not; during the past year about 175 houses and places of business were wired in this way and wiring facilities were increased in 100 other buildings. Not all the wiring in this town is done by the plant, as city contractors are very active. As a result of this practice the commercial load is increasing very rapidly.

Lamp renewals are not made free, a charge of 20 cents being made for 16-cp lamps. It is the practice to use the most efficient lamp that can be obtained and while customers are permitted to buy lamps outside, the management insists that they must show a certain efficiency. This practice not only decreases the load but it gives the customers better illumination, and in all arguments over this point, it is demonstrated to the customer that he saves current by using the more efficient lamp. There is no natural gas in the town and artificial gas sells at 70 cents per thousand. The management has literature demonstrating that electric lighting costs only about 10 per cent more than gas with Welsbach mantles, considering renewals on globes and mantles, and with the added advantage of being clean and hygienic. In wiring new houses the superintendent makes a personal inspection of the work and offers suggestions as to the best types and arrangements of fixtures and the best decorations to use in order to secure the most satisfactory illumination.

| HOUR. | INCANDESCENT DYNAMOS. | | | | ARC DYNAMOS. | | | | ENGINES. | | | | BOILERS. | | | | | REMARKS. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. 1. | | No. 2. | | No. 1. | | No. 2. | | No. 1. | | No. 2. | | | No. 1. | No. 2. | No. 3. | No. 4. | Engineers on duty will report all trouble, and other matter of importance. |
| | Amperes. | Volts. | Amperes. | Volts. | No 1 Cir. | | No 2 Cir. | | | | | | | | | | | |
| | | | | | Start | Stop | Start | Stop | Start | Stop | Start | Stop | Steam. | Water. | Water. | Water. | Water. | |
| 6:30 P.M. | | | | | | | | | | | | | | | | | | |
| 7:00 | | | | | | | | | | | | | | | | | | |
| 7:30 | | | | | | | | | | | | | | | | | | |
| 6:00 A.M. | | | | | | | | | | | | | | | | | | |
| Total | | | | | | | | | | | | | | | | | | |
| Average | | | | | | | | | | | | | | | | | | |
| K. W. | | | | | | | | | | | | | | | | | | |
| Meter Reading | | | | | | | | | | | | | | | | | | |

The systems of records and accounts are much more complete and detailed than is usually found in a small municipal station of this kind. Card systems are used in keeping records of the accounts of customers and of the expenses and output of the station. When a customer makes application for service it is entered on an order card showing the name, residence, how order was received, date, time, description of service desired, remarks and signature of applicant. When the connection is made, a brass tag is sealed to the meter, which carries the customer's number, and this number is used in all accounting. A service connection card is filled out showing the service number, card number, transformer, transformer size, meter number, meter size, street, pole number, date, number lights installed, distance from transformer, remarks and signature of workman. The customer's number is used for the page in the meter book and a page of the same number is inserted in a loose leaf ledger. In making bills the customer's number is used with a prefix of the number of the month. Invoices are copied in a tissue leaf bill of sale book, and there is a similar bill of sale book for supplies furnished. Monthly collections are made, but all bills are rendered every two weeks.

Records of current produced are very complete. The daily station report shows a half hourly record of volts and amperes for each generator, time of starting and stopping of generators and engines, and water and steam conditions of boiler, with trouble remarks. Sheets are footed daily so that the totals, averages, kilowatt and boiler meter readings are shown for each day. These are recapitulated from week to week and month to month and a card system shows the exact conditions for any period of any year with comparisons with the previous year.

The general accounts include general expense, office expense, street lighting expense and commercial light expense. The vari-

ous sub-divisions include: Bond account, premium and interest account, general and police fund account, commercial lighting account, street lighting account, construction fund account, profit and loss account, office expense account, accounts receivable account, wiring and supply account, electric rents fund account, and construction account. All items of expense and salaries are charged to the account to which they belong or divided between certain accounts on the basis of time spent in certain work or proportioned according to the current output. Thus the day fireman and engineer are charged to commercial lighting, the night men are charged 35 per cent to street lighting and 65 per cent to commercial. The entry for the chief engineer is divided, as his services are necessary regardless of the output. The lighting portion of the superintendent's salary is charged 75 per cent to commercial and 25 per cent to street lighting, as this is about the division of his time in the lighting business. He also has charge of the waterworks business which is conducted by the village, but for which there is no plant, the water being supplied by Cleveland and metered at the city limits, the village maintaining its own distributing system and collecting its own rents. The superintendent attends to all collections for both departments, so that his salary is divided between the two departments.

The operating force includes the superintendent, two engineers, two firemen, one coal handler, two linemen, who also attend to work for the water works department, one general man who attends to meter reading, soliciting, etc., and a bookkeeper.

No free lighting is furnished to anyone or any of the city departments. All lighting in public buildings and in the plant itself is metered and charged to the proper account. Superintendent C. G. Beckwith has considerable more leeway than is usually accorded to the operator of a municipal plant. He has been in charge since the plant was installed, and credit is due him for its efficient state. Following are some extracts made from Mr. Beckwith's last annual report:

| | |
|---|---|
| Total cost of plant | $63,537.90 |
| Total receipts, 1905 | 24,134.50 |
| Total operating expenses | 12,292.45 |
| New construction in 1905 | 5,377.73 |
| Profits after paying new construction | 5,530.00 |
| Total incandescent output | 452,028 kw-hours |
| Total arc output | 119,232 kw-hours |
| Total output of plant | 571,260 kw-hours |
| Total coal used | 2,018.9 tons |
| Average number arc lights operated | 94 lamps |
| Operating cost per arc lamp | $47.80 |
| Cost per kw-hour sold | 4.9 cents |
| Cost per kw-hour generated | 2.7 cents |
| Average price per kw-hour sold | 6.3 cents |
| Average price per kw-hour generated | 3.4 cents |
| Profit per kw-hour sold | 1.4 cents |
| Profit per kw-hour generated | 0.7 cent |

## Central Station Notes from Indianapolis.

The Indianapolis Light & Heat Company is just completing a large steam plant about two miles from the downtown district on Mill Street. Here two 1500-kw Curtis steam turbo-alternators have been installed and space is left for one of 5000 kw. Condensing water is obtained through a 4-ft. tunnel 1900 ft. long running from the power house to Fall Creek. Perhaps the term "horizontal well" would be more exact, as the tunnel is closed at the creek end and the water is all obtained by seepage between the brick and concrete blocks of which it is built. The lower half of the tunnel is built of concrete blocks dovetailed into each other and the upper half is of brick. The discharge tunnel is located directly above this intake tunnel. Both tunnels are a considerable distance under the ground much of the way from the power house to the creek.

The power-house turbine room is designed without any basement, all the pumps and other operating machinery being on the floor level. The feed pumps are located in the turbine room, but can be controlled by a long valve stem from the floor of the boiler room, which is considerably above that of the turbine room. The boiler room is designed with rows of boilers at right angles to the turbine room in order to get a sufficient capacity of boilers opposite each turbine unit.

The turbo-generators are 4100-volt, three-phase, star connected. By connecting from the neutral to the outer leg of any circuit, 2300 volts for standard lighting distribution is obtained, while the benefits of 4100-volt transmission are secured. The company has a direct-current three-wire net work in the downtown district of Indianapolis to supply which from this new power station motor generator sub-stations will be installed. The company has begun to use three-phase transformers for supplying three-phase induction motors in connection with its power service.

The company has not made much effort recently to get new business, because until this new power plant was in operation it would have been unable to carry more load had it been secured. But one solicitor is employed. The intention is to go after new business more actively now that the new power station is being completed.

Natural gas competition is a thing of the past in Indianapolis, the Indiana gas fields having been practically exhausted and the Indianapolis natural gas service discontinued. Mr. T. A. Wynne, superintendent of the Indianapolis Light & Heat Company, states that the competition of natural gas was never felt much in high-class lighting.

## Central Station Notes from Kokomo, Ind.

The Kokomo, Marion & Western Traction Company supplies central station electric lighting and street railway service in Kokomo and operates an interurban line between Kokomo and Marion, Ind. Although the interurban line is in prosperous condition, Mr. T. C. McReynolds, general manager of the company, believes that the central station end of the business offers much greater opportunities for growth than the railway, and thinks that this is true of such combined properties generally. He points to the fact that his company's light and power business increased 33 per cent last year, which was more than any ordinary railway property can show. He considers that he is as yet only skimming the surface in his community as far as light and power business is concerned; that the company's output should be increased year by year and the rates reduced, and that the central station manager should not be satisfied until he has well loaded light and power mains on every street in a town.

### LIGHTING FROM INTERURBAN RAILWAY TRANSMISSION LINES.

The company is lighting the village of Swasey (population 2000) with current supplied over a 10,000-volt, three-phase, 60-cycle transmission line supplying the interurban railway. For lighting this village a sub-station transformer reducing from 10,000 volts to 208-104 volts secondary is employed. The distribution in Swasey is by a three-wire 208-104 volt system. The transformers are located in the interurban railway sub-station. The company also at present writing is preparing to light Greentown, which also has a population of about 2000. Mr. McReynolds believes that it would be to the advantage of many other interurban railway companies to take on this kind of business. The cost of supplying village lighting by this means is far below what it would be with a separate lighting plant in the village. In this connection it is of interest to note that the transmission is at 60 cycles instead of 25 cycles which is the usual frequency employed on interurban railway transmission lines. Sixty-cycle rotary converters are used for the railway supply in the sub-stations but at the main power station in Kokomo a motor generator is used to supply the street railway instead of a rotary converter. All power is generated at 2300 volts, 60-cycles.

### POWER STATION AND POWER COSTS.

The power station is a new plant with compound condensing engines. An Allis-Chalmers steam turbine of 1000-kw has recently been ordered. The company's power station records show in a striking way the influence of load factor and load on power station economy. The cost per kw-hour for February, 1905,

before the interurban railway was started and when the light and power load was 33 per cent less than a year later, was about 1.4 cents per kw-hour. The cost per kw-hour in February, 1906, averaged .89 cent varying between 1 and .86 cent per day. The output for the latter month was about 6800 kw-hours per day. The load factor for the combined railway and light plant on week days is now about 60 per cent. That residence lighting has been given some of the attention it deserves in Kokomo is shown by the fact that the evening peak in February extends over about 3½ hours.

The voltage regulation on the light and power service is at present very bad owing to the fact that the same generators supply both railway and lighting and no automatic voltage regulators are used. The company does not furnish free lamp renewals.

ELECTRIC HEATING.

The company put out 50 flat irons in December, these being taken on by the company's regular solicitor. These were placed on trial and some came back, but those coming back were soon placed with other customers. The irons have been sold at their cost to the central station company.

Mrs. F. Violet Sanborn recently gave a week's lectures on cooking by electricity, as previously mentioned in these columns. The company's rates are rather favorable to electric heating devices. They are 12 cents per kw-hour for residences and 10 cents per kw-hour for commercial purposes. Energy in excess of 30 hours' use of a customer's connected load is billed at 15 cents per kw-hour. Up to 120 hours of use and over and above 120 kw-hours the rate is 4 cents. One man, a technical graduate, tests and reads all meters and acts as solicitor.

## Progressive Central Station Work at Lewiston, Pa.

Mr. E. M. McCabe, general manager of the Mifflin County Gas & Electric Company, of Lewiston, Pa., sends the following note in response to a query in these columns as to any central station which has done as well as the central station at Janesville, Wis., the business methods of which recently furnished the subject of an article.

The population within the limits of the Lewiston central station district is about 10,000. The station connected from January 1 to April 1 twenty-two residences and sixteen business places, consisting of stores, restaurants, laundries, churches, skating rinks, etc. From April 1 until April 13 twelve new customers, all residences, were connected. Each residence connected has twenty or more lamps. No special inducement to get these customers was offered, there are no solicitors on the central station staff and no advertising has been done. The rate is 12 cents per kw-hour, less 10 per cent discount for cash.

## Priming Caused by Poor Circulation in a Boiler.

Prof. D. S. Jacobus, of Stevens Institute, Hoboken, N. J., has recently made some experiments to demonstrate how priming in a boiler may be caused by the poor circulation of the water contained therein. A small vertical tubular boiler of ordinary construction, was used, with the water-heating surface enclosing a circular grate and with tubes leading directly upward from the combustion space above the fire to the upper tube-sheet at the top of the boiler. The steam was taken from the boiler at a point in the outer shell near the top of the boiler. When the boiler was run under normal conditions the steam generated was dry for ordinary rates of combustion, and superheated when the fires were forced.

In this class of boiler the temperature of the flue gases escaping from the tubes near the center of the tube-sheet is much higher than that of the gases from the outer tubes, and tests were arranged to determine whether there would be a gain in the economy through placing retarders in the center of the tubes so as to distribute more evenly the work done by the different tubes. In these tests the retarders were so adjusted that the temperatures of the escaping gases were made about the same for each of the tubes. After this was done there was an unexpected action through the boiler priming so severely that it was impossible to run it at other than a low capacity. The water level would be constant for a short time and the steam would be dry, when suddenly water would be thrown from the boiler along with the steam. On removing the retarders the priming disappeared, and on replacing them it was again present. From this it would appear that the retarders were the cause of the boiler priming.

Without the retarders the tubes near the center of the boiler were hotter than those near the side and caused an upward current of water at the center of the boiler and a downward current of water at the sides, the circulation of water being brisk and definite. With the retarders, however, all the tubes were at the same temperature and there was no tendency to produce a definite circulation, so that the water was for a time quiescent until after storing a certain amount of heat it would foam up and some of it would be thrown from the boiler.

## A Texas Pole Line.

One of the best electric light pole lines in the south is to be found in Texarkana, Texas. The poles are white cedar, 36 feet in length, with seven and eight-inch tops. All are painted with brown paint, and the butts are coated with tar. All poles are stepped with standard steps placed 18 inches apart.

The line is also graded at the top so that the top arms from one end to the other are absolutely level. In order to grade the poles at the top it was necessary to set some of them in the ground as far as nine feet on account of the fact that the alley itself is not graded and runs up and down hill. It was thought best to do this, however, because the alley probably will be graded soon and it then will not be necessary to reset any of the poles. No pole is set less than 5¾ feet in the ground.

The line is guyed at both ends by means of 30-ft. guy stubs with "dead men" behind them buried in the ground to a depth

FIG. 1.—TRANSFORMERS ON POLE LINE.

of six feet. The "dead men" consist of pieces of bois d' arc about six feet long and 20 inches in diameter, and are coated heavily with tar. Galvanized ⅝-inch stranded guy wire runs from the guy stubs to the anchor rods that are bolted to the dead men.

All the poles are roofed. The distance from the top of the top arms to the peak of the pole is six inches, but any pole

that shows indication of decay at the top is roofed with galvanized sheet iron. Every pole is double-armed with two sets of arms, the top arms for high voltage lines and the lower arms for secondary wires.

The arms are of yellow pine and are painted red. They are the so-called alley arms made according to specifications used by the Chicago Edison Company. They are eight feet seven inches in length. The pins are spaced 14 inches, and are of locust. Every pin was given a coat of white lead before being placed in the arm.

The primary and secondary wires are "dead-ended" on insulating spools held by a through bolt to a bolt that passes through the double arms, and to which ⅜ guy wire is attached in order to take all strain off the arm that the latter may be at right angles to the pole. Strain insulators are installed on the guys holding the primary wires and also one large strain insulator on the ⅝ guy leading from the guy stubs to the dead men.

For the lower arms one-inch pipe is used as an alley arm brace to which is attached directly a T-iron brace to hold the upper arms in position. The bolts holding these braces pass through both arms and the block between the arms. These braces will hold a heavy lineman working on top of the arms at the end of same. All poles are wrapped with galvanized sheet iron at points where guy wires pass around them in order to prevent cutting into the poles.

Primary wires are run on adjacent pins on the top arms and secondary wires on adjacent pins on the lower arms. The secondary wires from the transformer tap three No. 4 wires running at right angles to the main lead. Straight jumpers run from these wires to the three No. 0 wires on the alley lead.

Mr. A. T. Lloyd, who is now electric superintendent of the Shreveport Gas, Electric Light & Power Company, had charge of the work. Mr. Lloyd was formerly with the Chicago Edison Company.

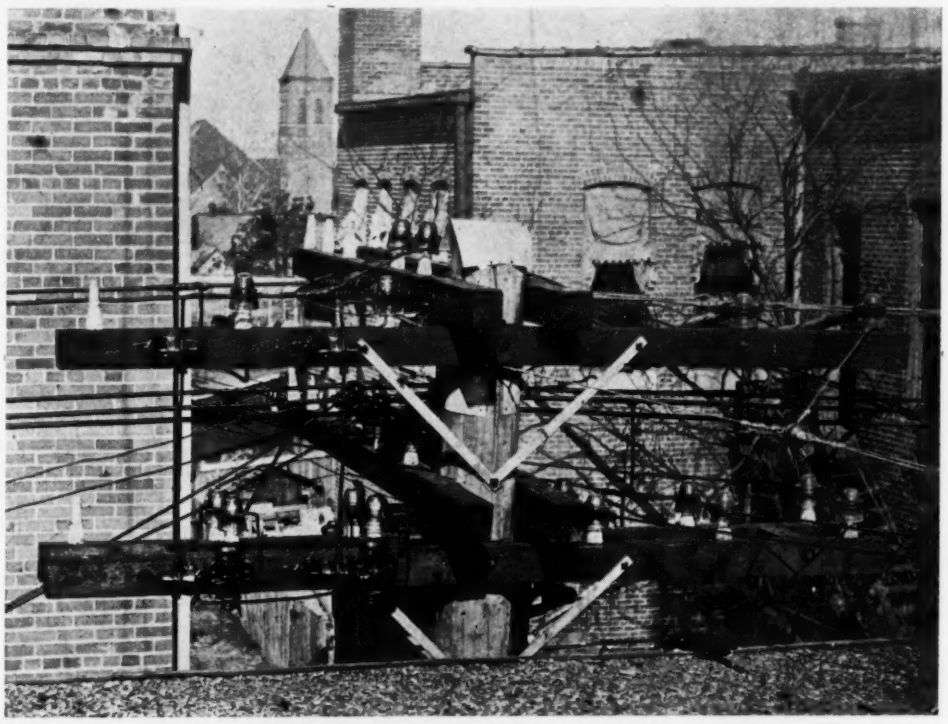


FIG. 3.—ELECTRIC LIGHT POLE LINE IN TEXARKANA.

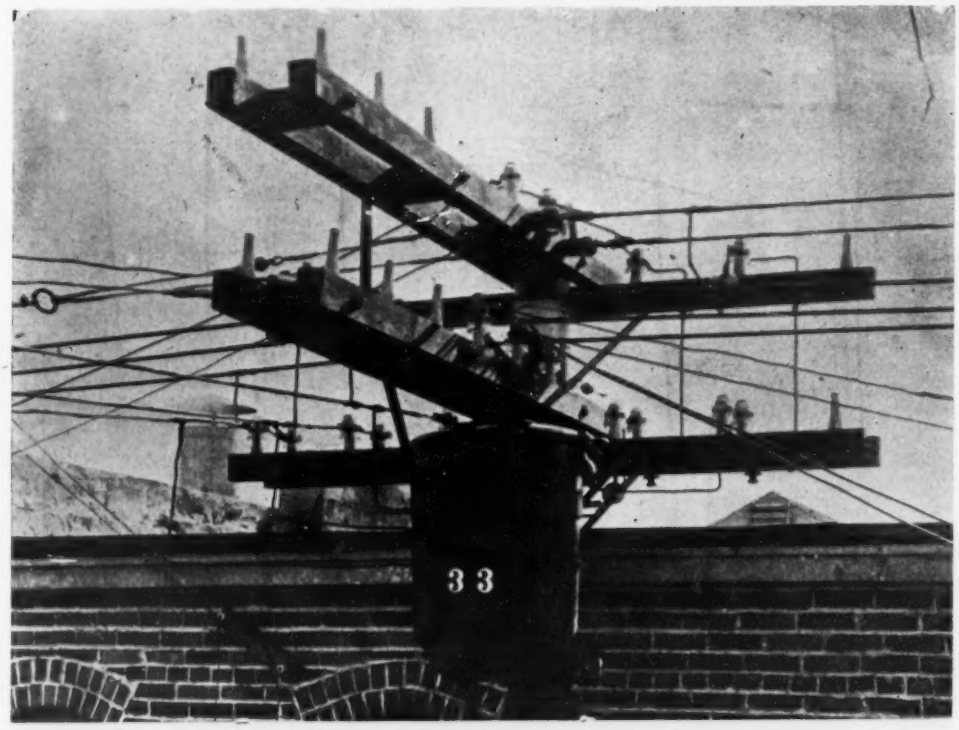
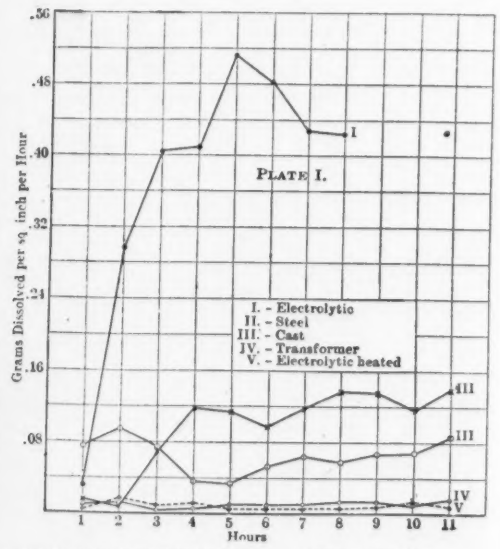



FIG. 2.—ELECTRIC LIGHT POLE LINE IN TEXARKANA.

## Corrosion of Iron by Acids.

In a paper presented at the ninth general meeting of the American Electrochemical Society at Ithaca, N. Y., May 1 to 3, Messrs. C. F. Burgess and S. G. Engle say that the rate with which iron corrodes or combines chemically with its surrounding medium depends upon various factors, including temperature, nature of the chemical agent, speed with which the resulting compound is removed and the physical and chemical state of the iron itself. The authors give the results of a few observations made in connection with a more extensive study of electrolytic iron under a grant from the Carnegie Institution of Washington. These observations deal mainly with the rapidity of solution of several grades of iron in dilute acids.




CURVES SHOWING CORRODIBILITY OF VARIOUS IRONS.

The corroding mediums employed were normal solutions of sulphuric and hydrochloric acids; distilled water and chemically pure acids being used. The several grades of iron which were compared included electrolytic iron deposited from a mixed sulphate and chloride solution, the same iron which had been heated to about 1,000° C. and allowed to cool slowly, soft sheet iron

known as transformer iron, a temper steel and an ordinary grade of cast iron. The relative rates of corrosion during the progress of the test are shown graphically in the curves shown herewith. The unheated electrolytic iron was attacked vigorously and evolved hydrogen rapidly.

The investigators conclude that the percentage of purity is not the controlling factor, since electrolytic iron having the same chemical composition exhibits wide variations in the rate of solution when heated. The crystalline or granular structure of iron seems to influence the rate of corrosion in a marked degree. The rapidity with which unheated electrolytic iron liberates hydrogen in a dilute acid solution suggests a useful application of this material in the production of pure hydrogen by replacing zinc; electrolytic iron liberating hydrogen about four times as rapidly as pure zinc and twice as rapidly as commercial zinc. One pound of electrolytic iron produces 16 per cent more hydrogen than does one pound of zinc, and if a sufficient demand for iron for this purpose should arise, it could be supplied at a cost materially less than that of zinc. While the measurement of electric potentials of iron against corroding agents seems to afford some indication as to the rapidity with which it will become attacked, the authors state that it does not seem possible to establish definite relations between electric potentials and corrodibility.

## Practical Installation of Electrical Apparatus.

BY THOMAS W. POPPE.

When setting an electric generator in a dynamo room it is important that the foundation prepared for it be strong and firm. If the foundation be built of brick these should be well set and grouted so as to eliminate air spaces; and if concrete be used the ingredients should be well mixed and tamped. The method given below will be applicable to any size of generator liable to

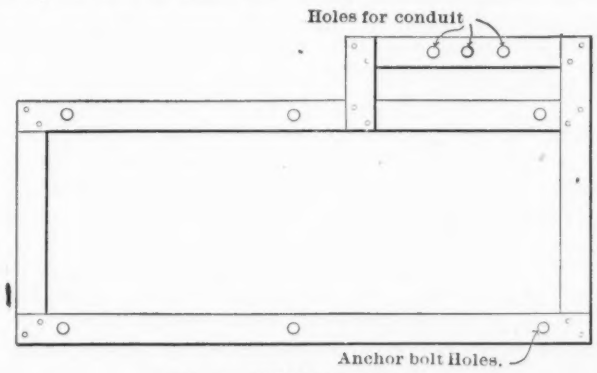



FIG. 1.—DYNAMO TEMPLET.

be handled by the ordinary central station, the largest machines usually being set by contractors making a specialty of such work.

If the generator is direct-connected a wooden pattern of the base should be made showing the location of the holes for the anchor bolts. This is called a templet and can be of pine seven-eighths of an inch thick and four inches wide for ordinary ma-

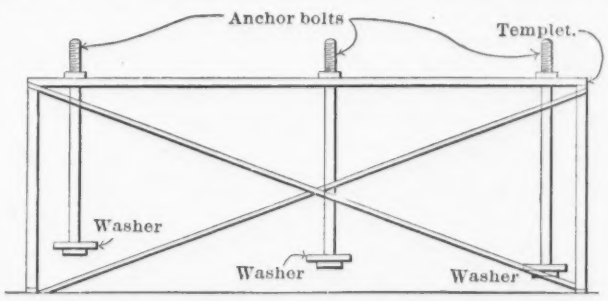
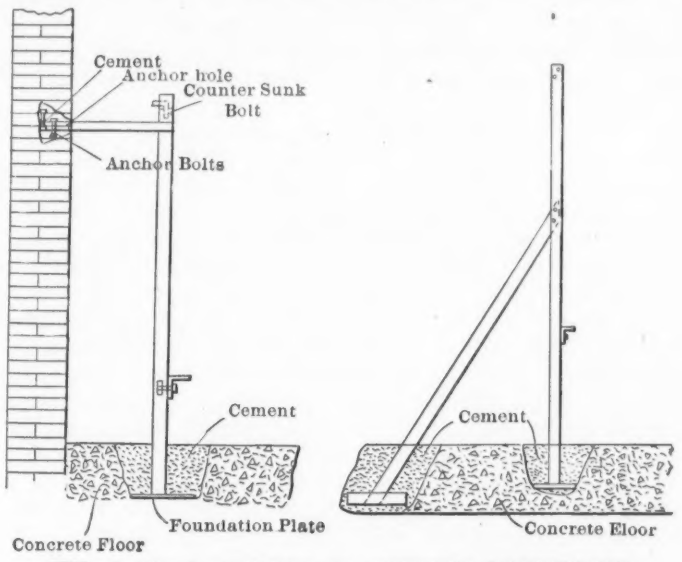



FIG. 2.—TEMPLET IN POSITION.

chines and as wide as necessary to allow proper size holes for the anchor bolts of larger machines, as shown in Fig. 1.

The templet should have holes bored for the insertion of the anchor bolts which are suspended head downward as shown in Fig. 2. The templet is then placed on uprights or a framework to hold it rigidly at the proper level. On the anchor bolts are placed large iron washers to prevent them from pulling upward and allowing the nuts to be tightened firmly. A second nut should be screwed above the first one to act as a lock nut. This prevents the vibrations of the engine from loosening the nut. A




FIGS. 4 AND 5.—METHODS OF ANCHORING SWITCHBOARDS.

loose nut or bolt will speedily loosen another and unless promptly tightened the foundation will be weakened and may have to be rebuilt. It is also apt to loosen the steam connection, causing a loss of steam and a waste of power. With the templet in proper position a walled enclosure of brick or wood is built up about it level with the bottom and afterwards filled with concrete. This insures a strong and durable foundation.

If it be desired that the conduit lines connecting the generator with the switchboard be run under the floor a strip of wood may be added with the proper size and number of holes for the conduit lines to the switchboard bored in it.

When the concrete has hardened the templet can be removed and the bed of the engine set. The bolts will fit each hole in the bed if the templet has been carefully constructed. The foregoing method is applicable to belted dynamos, motor, balancer sets and rotary converters.

The switchboard should be firm and neat. A suitable frame can be made of angle iron, as shown in Fig. 3. The size of

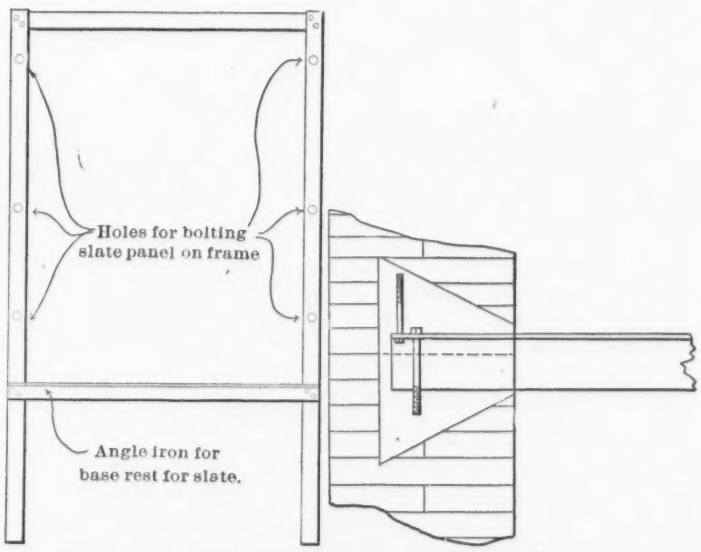



FIG. 3.—SWITCHBOARD FRAME.

FIG. 6.

the panel containing the switches should be ascertained before the frame is built and the frame should be constructed to suit.

The uprights of the frame should be made about two feet longer than the slate. This will allow six inches to set in the

cement floor and 18 in. between the floor and slate. The lower horizontal strip of angle iron should be set as shown in Figs. 4 and 5 so as to allow the slate panel to set thereon. This relieves the bolts holding the slate, whose only function will be to keep the slate from falling outward. Holes should be drilled through the upright angle iron to correspond with the holes in the slate panel. The angle iron will act as a washer for the rear of the slate board, but a leaden washer should be placed between the slate and the nut on the front of the board. This allows the nuts to be tightened firmly without danger of cracking the slate.

When the frame has been built, as shown in Fig. 3, holes should be cut in the concrete floor for the uprights of the frame. If in doing this the concrete should be pierced, that is, cut through to softer material, it is good practice to put a piece of flat iron, about 8 in. square or larger, according to the weight of the panel, under each upright. These serve as a foundation and prevent the board from settling afterwards. Some cement mortar should then be mixed and poured into the cavities surrounding the angle irons. Enough water to thoroughly wet the concrete should be sprinkled into the holes before the cement is put in. This causes the fresh cement to adhere to the older concrete. The frame should be set plumb and level and the angle iron on which the slate rests should also be made level.

Fig. 4 shows the frame anchored to the wall at the top. This is to render the construction as rigid as possible. The method of anchoring is shown in detail in Fig. 6. A wedge-shaped hole is cut in the wall and two holes are drilled in the angle-iron brace near the end. Two bolts are inserted in the holes thus drilled, one pointing one way and the other pointing in the opposite direction. When the brace is inserted in the hole in the wall the bolts are spread apart as shown and the hole filled with cement mortar. Another method is to drill a hole through the wall and use iron rod instead of angle iron for the brace. The rod is threaded on the end passing through the wall for the reception of a large washer and nut. If it is desired to conceal the latter a hole may be cut in the wall and the washer and nut buried by bricking up the outside again. Expansion bolts may also be used. If the board is not set near a wall it may be braced as shown in Fig. 5 or the uprights of the frame may be continued from the floor to the ceiling if this is not too high. On the end of the brace shown in Fig. 5 will be noticed a horizontal anchor. This anchor should not be omitted as the cement is liable to loosen around the angle-iron brace and render the structure weak.

## Modern Practice in Water-Wheel Operation.

At the Chattanooga meeting of the American Society of Mechanical Engineers, held May 1 to May 4 inclusive, a number of papers were presented dealing specifically with water-wheel operation, the subjects of the papers being as follows: "Some Stepping Stones in the Development of a Modern Water-Wheel Governor," by M. A. Replogle; "Regulation of High-Pressure Water-wheels for Power Transmission Plants," by G. J. Henry, Jr.; "Turbine Design as Modified for Close Regulation," by G. A. Buvinger; "Speed Regulation of Water Power Plants," by J. Sturgess; and "Efficiency Tests of Turbine Water-wheels," by W. O. Webber.

In Mr. Replogle's paper attention was called to the fact that a perfect governor must be susceptible of a greater range of adjustment than any other known machine. Its "reasoning" power must be prescribed for every power plant in which it is placed. It must "anticipate" the rapidity of gate movement, as well as the point to which the gate should be moved for every change in load. Both of these must be performed before the speed has begun to return to normal. It must hold itself in suspense until gravity has fully charged the water added with power and this power is extracted by the turbine. If the speed returns to normal too fast or too slow, the governor must of its own volition shift the gates to a new point of opening. There are thus four distinct acts of judgment that may take place in one change of load, and a smaller or larger change of load will require a change in all of the ratios. In case a second or third change in load occurs before equilibrium for the first change has been established, it is apparent that the governor's action must be further complicated. A perfect governor will not assure perfect regulation in a turbine plant because any of the following defects will cause erratic action on the part of the governor; Unbalanced gates; cramping or interfering in gates; ponderous, unwieldy gates; lost motion in gates; torsion in gate rigging; irregular effects of gatage; lack in power storage; obstructed intakes; long closed feed pipes; contracted feed pipes; short bends in feed pipes; slanting draft tubes; draft tubes too large or too small; loss or gain of vacuum. The first eight of these defects are mechanical; the last six, hydraulic.

The requirements of a good water-wheel governor are stated to be as follows: It should be simple and easily managed; it should be carefully and compactly designed; it should have a powerful and exceedingly sensitive control governor; it should embody a powerful and reliable gate-moving element, whose every movement is gradual or of a differential character; it should be limited in its velocity of gate movement to the hydraulic and mechanical conditions of the power unit; it should have enough temporary and differential drop to make it adjustable to the present day power unit conditions; it should have an adjustable permanent drop, so that this factor can be reduced to a minimum in the plant governed; it should be provided with means for temporarily changing the speed for synchronizing purposes, and this feature should be controlled from the operating board of the modern power plant; it should be built as accurately as present-day methods will permit; all of its important bearings should be self-oiling; it should be noiseless in all of its actions; it should require a minimum amount of power for the performance of its duties, and when it is not laboring but is waiting for inspiration, the energy required should be reduced to a mere driving of empty belts; the ideal governor should be mechanical in its every detail. The author describes a governor said to comply with the foregoing requirements.

In his paper on "The Regulation of High-pressure Water-wheels for Power Transmission Lines," Mr. Henry says that a modern high-pressure water plant is usually exposed to the danger of a break in the pressure pipe. Such a pipe frequently carries a large volume of water at from 200 to 1,000 lbs. per square inch pressure; and a break in this line in many instances would mean the complete wrecking of the power house. It is, therefore, necessary that the security of this pipe line be guarded in every way; and the old method of regulating turbine wheels by throttling the water is one that should not be adopted without installing suitable protecting devices, and even, then, only when it is the only available method. Of course in many instances, particularly where a large storage reservoir is available at the inlet of the pipe or at the outlet of the flume, or where the peak load is likely to exceed the normal capacity of the flume, or where it will exceed the normal flow of the stream, it becomes advisable to save all the water possible; and this can only be done by proportioning the water flow to the station load requirements. Some form of regulating nozzle is, of course, the best way of accomplishing this result, but it does not follow that the regulation of the speed should be coincident with the regulation of the water flow. It is necessary, in modern power transmission plants, to maintain the speed within close limits, and 1½ to 2½ per cent. is readily obtainable with well-designed and constructed apparatus. It is not customary to maintain voltages at the end of a transmission line by varying the speed, and therefore the voltage at the generator; modern practice invariably requires the maintenance of a constant speed and voltage. Fluctuations in voltage are then taken care of by varying the generator field or by accessory apparatus, as, for instance, the Tirrell regulator.

Governors of excellent design and machine construction are to be had, so that the problem which confronts the engineer of today is usually that of adapting the apparatus obtainable to the conditions to be met with in any individual plant. The general practice among turbine builders is to control the speed

of their turbines by cylinder or wicket gates, either device aiming to limit the orifice of discharge without varying the spouting velocity, and therefore maintain high fractional load efficiencies, although neither of these devices do this perfectly. Both are open to the defect of causing a variation in the velocity of flow in the pipe line, and therefore a corresponding water ram every time the governor checks the velocity. There is not, ordinarily, any trouble experienced, except in cases of extremely low head, due to the governor opening the gates too quickly and the water not getting up to spouting velocity quickly enough; but there is frequently great damage caused by the governor shutting the gates so fast that the pipe or the turbine case is ruptured by the resulting water ram. In order to guard against this, it is customary to install safety valves, which usually are out of commission, owing to their requiring too great an increase in pressure in order to actuate them, or due to their freezing or becoming stuffed with leaves, sticks, etc., carried by the water. Where there are a number of turbines fed by the same penstock, the water ram, due to a single machine closing, is not so serious as where there are but one or two on the same line; but the resulting change in spouting velocity, due to the monetary water ram, is then an objectionable feature, tending to cause a further increase of speed variation.

The author describes the Pelton type of water-wheel where a stream of water issues at full spouting velocity from a nozzle and enters the double-curved surface of a suitably designed bucket. This type of wheel is said to lend itself to a construction utilizing a deflection of the stream of water from the buckets in order to reduce the load that the wheel will carry at any instant of time, the stream being diverted off or on to the buckets. The paper describes in detail the practice followed by the Pelton Water Wheel Company in making installations.

Mr. Sturgess in his paper presents certain aspects of the problem of regulating water power plants, which are usually passed over with little consideration. These relate to certain fundamental elements of design in the water-wheel itself, and to characteristics of governor action as obtained in the best practice of the day.

In regulating a water-wheel it is not sufficient to confine attention to the governor only, since the problem is intimately connected with other important features of the plant. While the ultimate function of the gate is to control the power output of the wheel, opening or closing it slightly will not cause the power developed by the wheel to vary in like manner, for the reason that any sudden restriction cannot instantly check the velocity of the volume of moving water extending throughout the whole hydraulic system. The immediate effect is to cause the same volume of water to be ejected on the wheel, but with a higher velocity, thus actually increasing the power at the moment when it should be decreased or vice versa. In plants where the pipe line is long and the velocity of the moving water high, the gates cannot control the power output of the wheel within several seconds of the instant that the gate is moved, and no perfection in a governor can prevent momentary variations in speed. The reason for this is that the gates are placed immediately before the water-wheel, which takes up the energy of the stream. Attempts have been made to obviate this by placing the regulating gate elsewhere, as in one of the plants at Niagara Falls where the butterfly regulating valve is placed in the draft tube. At Shawinigan Falls on ordinary gate valve connected to an unusually powerful governor is placed in the penstock. While these minimize the deleterious effects referred to, they possess other drawbacks which make the automatic regulation of these wheels difficult.

Relief valves and stand pipes offer some advantages, besides removing the danger to the pipe line due to a sudden closing of the gate.

The best forms of relief valves are undoubtedly those which do not depend on a rise of pressure to set them in action, but which are mechanically opened synchronously with the closing movement of the gate, afterwards gradually closing automatically. By properly proportioning the discharge of such a valve to the discharge of the water wheel, the gate can be closed very quickly without producing an appreciable rise in pressure. A plant at St. Catherines, Canada, equipped with Voith relief valves and having pipe lines several hundred feet long, head being 298 ft., has been found to give remarkably good results when suddenly throwing off large amounts of power. The exact figures are not obtainable, but it is stated on good authority that the maximum momentary rise in speed on throwing off 75 per cent of the full load was under 4 per cent, an extremely good figure for such a plant. The units are of 7,000 horsepower, revolving at a high speed and having a large momentum factor. Further improvement in speed regulation depends greatly on the design of gates, but commercial reasons render it unlikely that any great departure in the principle of gate construction will be made.

The author then passes to a consideration of the governor, the most successful, he claims, being of the hydraulic type. The design and operation of a governor of this type is described at length.

Mr. Buvinger prefaces his paper on "Turbine Design as Modified for Close Regulation," with the remark that American manufacturers of water wheels have, as a rule, adopted the practice of connecting to the turbine a governor which is guaranteed by its builder to meet the requirements of the electrical machinery with which it is to be installed. This practice has left to the turbine builder the problem of fitting his wheels with gates that are as nearly balanced as possible, and that are connected to the governor by simple and strong gate work. As a result turbine builders have labored to keep all gears and wearing parts on the outside of the flume, where they are removed from grit in the water, and where they are easily accessible for observation and repair.

Among the many types of gates now in use, some are so nearly balanced that they may be used under great variations of head, while others are only suitable for low heads. The majority of manufacturers adapt their wheels to the specifications submitted, remaining partial to the type most generally supplied with their standard wheels. The cylinder gate and the swivel or wicket gate are the two types most used with the inward flow reaction turbine. The former in its simplest form is a plain iron ring fitting closely on the inside of the chute case and opening a part of all the chutes as it moves parallel to the axis of the shaft. Its part-gate efficiency is not so high as the swivel gate; but it is practically balanced on a horizontal wheel and is subject to little wear. For a number of years lips have been added to these gates to improve the part-gate efficiency; but this throws added work on the governor. The swivel gate can be almost entirely balanced, and has a slight tendency to close which is considered an advantage in case any part of the governor mechanism should become damaged. The part-gate efficiency of this type of gate is good, as the opening of each chute is reduced in such a manner that there are no eddies formed as with cylinder gates.

The draft tubes and feeders depend on the layout determined by the engineer who is governed by local conditions. Regulation is often rendered difficult by the character of the draft tube whose area should be such that at full gate the draft head is approximately equal to the distance of the shaft above tail water less the resistance in the pipe and the velocity head of the water leaving the draft tube. To decrease this velocity as much as possible the diameter of the draft tube is often increased at the lower end. As the quantity of water discharged decreases, the vacuum head also decreases and if the change be sudden the vacuum may be broken. To decrease this tendency the draft tube should be designed so that the water at the top has the same velocity as the water leaving the runner and the tube then tapered to the bottom, so that the water will leave with a velocity of from two to three feet. When wheels are placed in an open flume, or with a very short feeder from the turbine to head water, and a correct draft tube is installed, everything is favorable for good governing.

Where turbines are supplied by long feeders, the latter must be protected from violent shocks. The addition of a standpipe has given better results than any other method, and has been used successfully under heads as high as 250 ft. It should be placed as near the power house as practicable and should be of

sufficient size to supply water to the plant during the time necessary for the column of water in the feeder pipe to change from one velocity to the other under changes of load as high as 50 per cent at least. This water should be supplied without drawing down the head in the pipe more than a few feet, and the pipe should be supplied with an overflow a foot or two above the level of the head water. When thus designed, the head will not vary greatly in the feeder pipe and a rapid and close regulation is obtained with perfect safety to the feeder. In northern climates great care must be taken to keep the standpipe open and free from ice in winter, and this is usually done by lagging and sometimes by the introduction of steam pipes into the standpipe. In several plants installed with no protection to the feeder very grave defects have been overcome by adding this pipe after the plant had been in operation. If the feeder is almost vertical at the power house and then has a long portion with little slope, a much shorter pipe can be put at the beginning of the drop with very good results.

Where the head is so great that a standpipe is not practical, it is sometimes possible to arrange a by-pass that opens as the gates of the turbine close. There is no objection to this in places where the water is used for irrigation and must be supplied whether used by the wheel or not. With this device operated by the governor the velocity in the feeder remains constant and regulation is very simple. It is not, however, economical where it is desired to store the water, as in many plants where water is scarce.

In such cases the pipe is protected against the rise in pressure by adding relief valves which keep the pressure within a few feet of the normal head, but nothing can be done to accelerate the water when the gates open. Those operated by hydraulic pressure regulators are very satisfactory, but whether of this type or of the spring type they should be tested at least once a day.

Mr. Webber's paper is a record of a series of consecutive tests under uniform conditions of four water-wheels, with the same apparatus and the same observers, to determine their efficiency, and ascertain the effects of corrosion and wear upon the relative efficiency of the wheels; also to determine whether more modern wheels would show greater relative efficiencies, and whether it would be more economical to operate all of the wheels at part gate all of the time, or some wheels at full gate part of the time.

The tests, which were made on wheels of the mixed inward and downward flow type, are instructive because of the wide range of speeds and gate openings covered systematically and consecutively. They show conclusively that water-wheels should be run at the speed for which they are designed under any given load; that modern wheels, with coarser buckets having a spoon-shaped discharge depending below the guide ring of the wheel, and with the outer periphery of the bucket at discharge of greater diameter than the bucket at entrance, would give much more power, higher speed, and greater efficiencies from the same water than from wheels of older design without these modern improvements.

## Oil Required for Lubrication.

By Charles N. Bain.

Not infrequently engineers are approached by oil agents who claim that wherever their oil is used only one drop per minute is required to lubricate an engine regardless of speed, load or pressure and condition of steam. Since there may be some question as to exactly what is meant by one drop per minute, the writer presents some ideas that naturally are suggested by a consideration of this important subject in connection with long experience along these lines.

Fig. 1 shows a single connection lubricator in use on a pump. This lubricator works as well as others having double connections although the latter type of lubricator usually proves more satisfactory in practice. When the sight feed glass is filled with water according to common practice, and the feed started, each ascending drop of oil has a diameter equal to the inner diameter of the glass, resulting in a large drop. This, however, is unsatisfactory, since the oil moves slowly and leaves small particles clinging to the glass. Better results will be obtained if

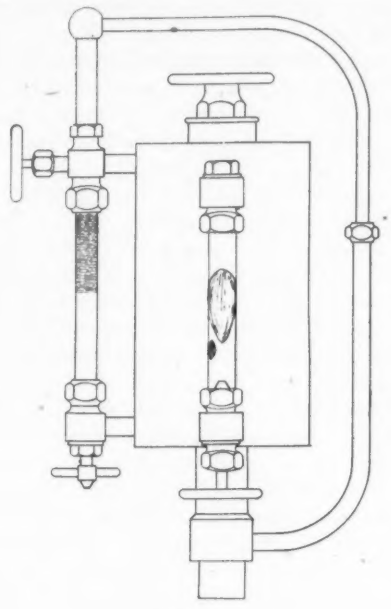


FIG. 1.

the plug is removed, the glass cleaned and the water replaced by glycerine. The drops of oil will then be smaller and follow each other in rapid succession, as shown by Fig. 2. One of the drops of oil as illustrated in Fig. 1 is equal to about six of those shown by Fig. 2, so that the one drop a minute argument will not hold.

Fig. 3 illustrates a lubricator in which there is neither glycerine or water, the oil dropping from above to the steam pipe through the lower connection. The sight feed glass is filled with steam, and owing to this fact it is possible to regulate the

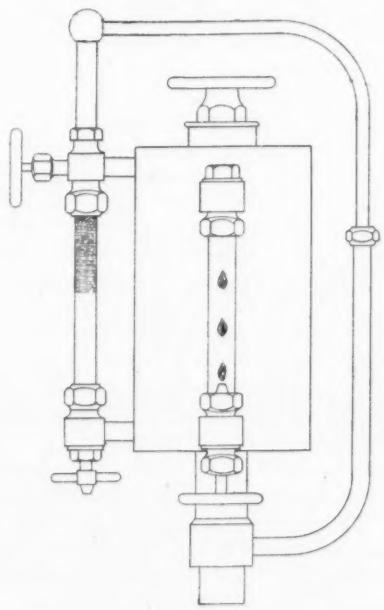


FIG. 2.

feed of the lubricator by the valve above the sight feed glass; but more attention is required in the regulation because the oil being at a temperature above that of boiling water will go through a very small opening, making it necessary to keep the regulating valve almost shut. It is impossible to feed large drops of oil through such a lubricator because if the feed is increased the oil flows in a stream and not in drops. The writer had such a lubricator in use near a window where in winter the location is quite cold; but on account of the principle which caused it to operate it was not entirely satisfactory,

and a lubricator like that shown in Fig. 4 was substituted. In this lubricator the oil ascends in large drops, each of which is four times as large as that delivered by the lubricator illustrated in Fig. 3.

Another point to be considered in this connection is that one drop of a certain oil per minute may be sufficient for an engine, while two drops of another oil may pass through in the same time, although both feed a pint of oil in ten hours. This is due to the fact that some oils will rise in larger drops than others under exactly the same conditions. When making comparisons of this kind, care should be taken to know that the conditions are alike, as some engineers ignore small differences which may or may not give different results.

The sight feed glass in Fig. 5 is located so that it is shielded from the direct radiation of heat from the steam pipe, consequently the water standing in this glass is not very hot, making the drops of oil large accordingly.

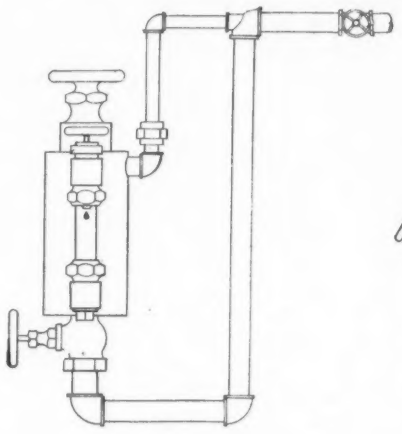


FIG. 3.

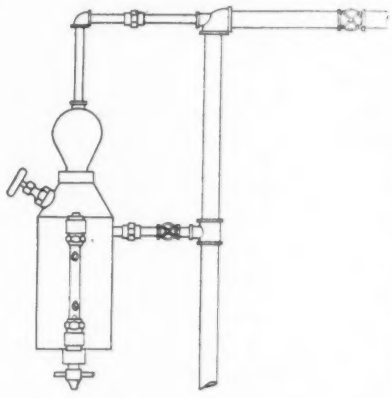


FIG. 4.

In Fig. 6 the sight feed glass is close to the steam pipe, hence the drops are smaller than they otherwise would be. If these two lubricators were located in comparatively cool places, this difference will be more marked as the glass nearest the steam pipe will be comparatively warmer than if both were placed in a very hot room.

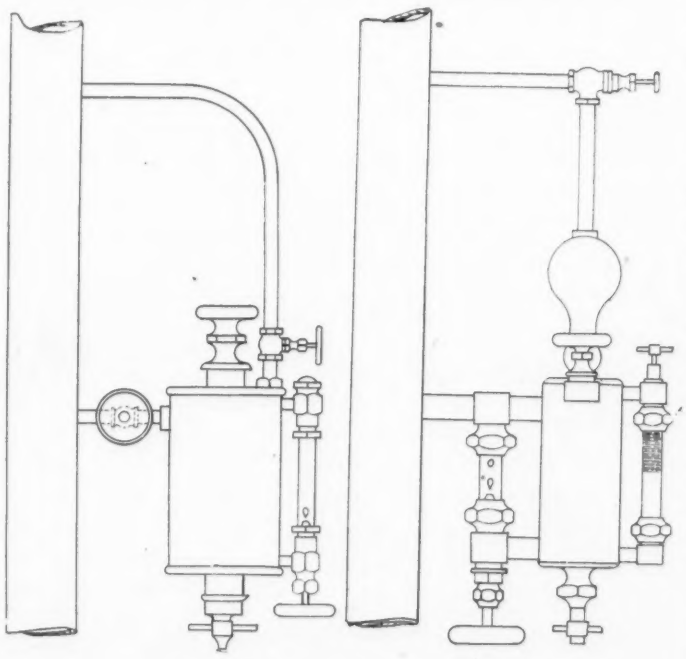


FIG. 5.



FIG. 6.

Fig. 7 illustrates a lubricator in which it is impossible to tell how large the drops are, because they slowly pass between the little round sight feed glass shown, and a nickel-plated reflector placed directly behind it. The brightness of this reflector is clouded for a moment as the dark colored oil passes over it, but this gives only a faint idea of the size of drop which is passing.

Fig. 8 illustrates a lubricator that was located in a place that was cool on winter mornings, but later in the day became much warmer. It is plain that cold oil requires much more pressure to force it out through a sight feed nozzle, than warm oil. On a cold morning the valves, 2 and 3, should be opened, and valve 4 closed, thus making available the high column of water in the condenser pipe; but on a warm day it is difficult to regulate the feed as desired, on account of the pressure. It is then proper to close valves 2 and 3, and open valve 4 thus reducing the pressure forcing the oil through the delivery valve 5. In this connection it may be well to state that the only pressure operating to force the oil into motion, is the unbalanced pressure due to a column of water standing above the body of oil in the lubricator; therefore it would feed just as well if the machine were not connected to a steam pipe, provided the stand pipe be kept full of water.

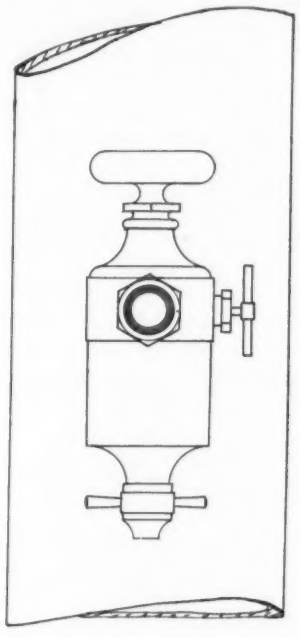


FIG. 7.

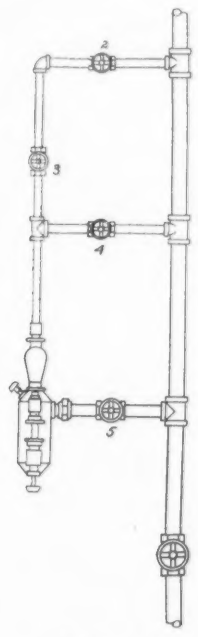



FIG. 8.

Another fallacious statement made by some oil agents is that one drop of oil per minute will lubricate any style of engine without regard to design. Several years ago the writer had charge of a Corliss engine, which if not given sufficient oil would grunt and groan at the valves, although the piston emitted no sound. In contradistinction to this the writer is at present operating an engine fitted with double beat poppet valves which require no lubricant at all, and during 12 years of service the piston of this engine never gave a sound, although some days it received but a small quantity of oil. It is not sensible to claim that the same quantity of oil is sufficient for both of these engines, although they are nearly the same in size and have practically no difference in the piston speed.

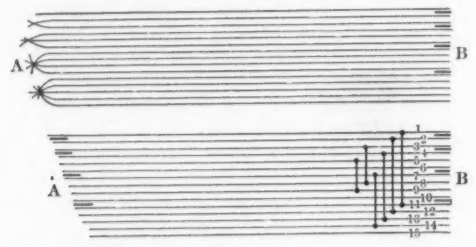
A certain engine was fitted with unbalanced, semi-rotary valves that worked hard, requiring thorough lubrication. An oil agent sold the proprietor cylinder oil one drop of which was guaranteed to lubricate this engine for one minute. The engineer found that two or three drops were needed to secure satisfactory results, but the proprietor would come into the engine room and reduce the feed to one drop. The result was a battle of words in which the engineer was victorious, after which he used his best judgment about oiling his engine without interference from his employer. If an engineer is not competent to decide on the quantity of oil required for his machinery, he cannot be considered a proper man to have charge of a plant, therefore a better engineer should be secured for the place, and given full charge of it. One of his duties consists of deciding how much oil each engine under his care requires, as no cast iron rule can be laid down for this purpose.

# LETTERS ON PRACTICAL SUBJECTS.

### A METHOD OF TESTING OUT AND NUMBERING WIRES.

In these days of many conduits and cables it is sometimes desired to identify wires at both ends of long conduits or cables when reliable assistance and suitable signaling apparatus are not at hand. The method outlined below has been devised and put to practical use by the writer with satisfactory results. In use it does not prove as complicated as would appear by an inspection of the sketch. With almost any number of wires it is only necessary to make one trip to the distant station to identify every wire.

Commencing at station A, Fig. 1, the wires are connected together in groups, as shown, each group containing one more wire than the preceding one. Proceeding to station B, the ends are carefully separated so as not to be in contact with each other at any point. Taking any suitable testing instrument, as a bell and battery, magneto, or galvanometer, a test is made




FIGS. 1 AND 2.—TESTING AND NUMBERING WIRES.

between any one wire and all the others remaining to ascertain the members of that particular group. By this means the wires are readily separated into groups corresponding to those at station A. The wires can now be numbered, commencing with the separate wire, and numbering the wires in each group in the order shown.

It is now desirable to make a sketch as shown at Fig. 2. One wire from each of the smaller groups is connected to a wire in the largest group, and such other connections as are necessary are made between the intermediate groups, being careful not to have more than one wire in any group connecting any other one group. Proceeding to station A, the groups are kept separate by tying a string or wire around each group. The ends are then disconnected, and taking any wire in any group, test until the only other wire connected with it is found. The diagram will indicate what number should be placed on each wire. For instance, if we find a circuit between a wire in group 2 and group 5, the diagram shows that the wire in group 2 should be numbered 2, and the wire in group 5 should be numbered 12. The two wires connecting groups 3 and 4 are shown to be 5 and 9 respectively. Those not connected, of which there must not be more than one in each group, are also indicated by the diagram.

Philadelphia, Pa. Leslie Griscom.

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### QUESTION IN THE PARALLEL OPERATION OF ALTERNATORS.

Many of the accidents which occur in power plants escape investigation especially if the results have not been particularly disastrous to the machinery or have not disturbed the system to any great extent. Yet it is often these minor disturbances which are instructive and their study brings out many interesting points. The plant in which the following accident occurred has an output of 15,000 horse-power, the generators being 3,000-volt two-phase machines direct-driven by the engines. The generators operate in parallel and are excited from a common bus to which are connected four engine-driven 220-volt compound-wound exciters of 75-kw capacity each. The first intimation of trouble was the sudden diminution in the intensity of the light given by the lamps, these gradually becoming dimmer and dimmer until they were finally extinguished. There was no flashing or noise to indicate where the trouble lay; but one of the exciter ammeters indicated a short-circuit on the direct-current system. Several minutes were spent in darkness inspecting the several exciter units scattered about the place until one was found that was not running at all due to the breaking of a valve stem. This machine was still connected to the bus-bars; but when the breaker was opened the lamps on the alternating-current system began to brighten up and the alternators pumped violently. Fully a minute had elapsed before the full voltage of the system was restored and the machines were again running quietly, and during that time four of the breakers had opened.

The puzzling part of the matter was what kept the machines in step during the period in which the system was practically dead, as indicated by the recording instruments. The exciter breakers are not automatic in this plant, it having been found preferable to allow the operator to use his judgment in opening them in case of trouble, than run the risk of permitting the breakers to open on a momentary short circuit. To those who have never experienced trouble of this kind, the problem should prove both interesting and instructive. The writer is of the opinion that the machines were not in step during the short circuit and were forced together as the exciters slowly built up their field excitation; but would be pleased to have the opinion of others on this matter.

New York. Lewis C. Reynolds.

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### PECULIAR BEHAVIOR OF INCANDESCENT LAMP.

Referring to Mr. C. A. Carpenter's trouble with an incandescent lamp as noted in the April 7 issue, I would suggest that this particular lamp which flickers while the others burn apparently steady, is adapted for a 55-volt circuit instead of a 52-volt circuit; and I believe that if he would burn his lamp on a circuit of higher voltage the flickering will disappear. The cause of his trouble is poor regulation which affects the candle-power of the higher voltage lamp to a greater extent than it does the other lamps which are designed for 52 volts. In the process of manufacture it is impossible to make all lamps come out at the voltage aimed at. The lamp while possibly marked 52 volts is better adapted for a circuit of higher voltage. If the main supply drops to 51 volts, the 52-volt lamps will not suffer the same decrease in candle-power as the lamp intended for a higher voltage, and greater drops in voltage affect the high-voltage lamp still more.

Philadelphia, Pa. W. D. C. Dodge.

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With reference to Mr. Carpenter's flickering lamp, I would suggest that he examine the lamp closely for defects. I had a somewhat similar experience some time ago with a lamp having a T.-H. base. I examined the lamp and found that the screw cap of the base was loose, and had cut the leading-in wire at the point where it was soldered to the cap. Possibly Mr. Carpenter's flickering lamp has a somewhat similar defect.

Iron Mountain, Mich. R. C. Lindahl.

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### THE ECONOMICAL PROVINCE OF ELECTRIC HEATING.

The conditions and circumstances which determine the value of electrical energy as a source of heat are matters that have received the attention of the writer for a long time. In every line of industrial enterprise there is a common goal toward which all must converge. It is not the sole aim of the central station man to grind out kilowatt-hours regardless of the methods employed or the apparatus made use of; if it were, many would be using the primary battery or the "thermo infant." The kilowatt-hour—the finished product—has a particular value no matter how obtained, and this value is neither enhanced nor diminished by such things as the personal equation or the methods employed in its production. The same laws and the same generalization apply to the production of heat. Long before the present generation the patient investigation of Joule had

given the world a measure of the quantity of heat and a simple means of comparing a given quantity of heat with mechanical effect; demonstrating that a certain quantity of one was equal to a certain quantity of the other. Joule's experiments indicated that 772 foot-pounds was equivalent to one thermal (Fahrenheit) unit and this was long accepted as the mechanical equivalent of heat until a more exact determination made by the late Prof. Rowland, of Baltimore, established this value at 778 foot-pounds.

The relation between the heat unit and the foot-pound having been established, and the relation between the watt and the foot-pound being known, it is easy to express the heat unit in terms of the watt. This done, we are in a position to investigate the heating problems using the kilowatt-hour in the case of electricity as our unit of measure and the familiar ton when obtaining heat by the direct combustion of coal. We will make the price of the ton of anthracite coal $6.50 and the price of the kilowatt-hour at 10 cents; 1,054.8 ÷ 3,600 watt-seconds = .0293 watt-hour = .0000293 kilowatt-hour = 1 heat unit. Calling the thermal value of our coal 14,500 heat units per lb. we obtain 14,500 × 2,000 = 29,000,000 heat units in one ton of coal, and multiplying the electrical equivalent of 1 heat unit by 29,000,000 × .0000293, we obtain 849.7, which, figured at 10 cents per kilowatt-hour gives $84.97 as the cost of a quantity of heat which can be obtained for the price of $6.50 by the direct combustion of good anthracite coal.

This article was suggested by reading a short item in the March issue of the ELECTRICAL WORLD under the heading of "Power in the Home." It is highly probable that the financial aspect of the matter had not received serious consideration and it is earnestly hoped that the economical side of the matter will be considered at least before electrical heating bills with exponents begin to come in.

The electrical heating of street cars is admissible and even necessary for good reasons; the practice of heating cars by stoves is too hazardous to even be considered and steam for this purpose is not available as in regular train service. Moreover, street railway companies when supplying power for their own use compute the cost at not much more than the extra quantity of coal burned to produce the power needed for heating purposes.

Electric heating has its own particular sphere of usefulness, and in certain cases its adoption will prove very economical. The adoption of electricity for general house heating, however, is a bold departure, to say that it would be extravagant is putting it mild. For such service as heating flat irons, soldering irons, etc., where only a small quantity of heat is wanted, and where it is very desirable that the heat shall be localized, electricity is the ideal agent for such work, as its use ceases as soon as the allotted work is performed. With the combustion of fuel (gas excepted) there is more or less waste because the combustion is allowed to go on when the heat produced is not needed, and in many instances this waste heat serves to make the surroundings uncomfortable. Apart from the heating of street cars (and other electrically-driven cars as well), electricity has a wide and extensive field of usefulness in electric welding, and in connection with the manufacture of such articles as calcium carbide, carborundum, etc.

The intense heat obtainable by electrical means only, bringing about the union of many metals dissimilar in character and effecting fusions of the most refractory substances. Without this potent agency several of our leading industries would not be commercial possibilities. The fact that electricity cannot be used economically for general heating should not discourage those that appreciate its very desirable features apart from the matter of its increased cost. It is only within recent years that the dynamo has attained commercial importance. Time was when entire dependence was placed on the wasteful and expensive primary battery. Who knows but what future discoveries will place the production of electrical energy on a basis as far in advance of the present, as the present is in advance of the past?

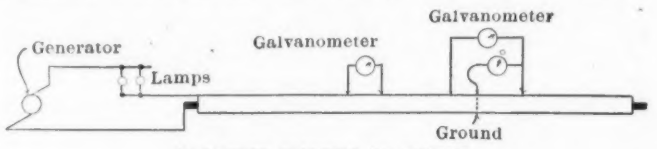
NORTH ADAMS, MASS. T. H. REARDON.

### LOCATING GROUNDS IN CABLES.

In using the Varley or Murray loop test for locating grounds in cables, the results are not satisfactory, due to faulty resistances in the conductors and to the difficulty of making perfect connections for the test. In lead-covered cable a ground or grounds between conductor and lead or conductors and lead can be located exactly, in the following manner:

Connect the lead sheath to one side through an adjustable resistance (lamps can be used) and the copper to the other side of any direct-current circuit and regulate the resistance so that two or three amperes will flow through the lead, the short-circuit and the grounded conductor. Use a galvanometer with leads having sharp metallic points for contact terminals and place the contacts a few feet apart on the lead sheath.

When there is a deflection on the galvanometer the testing connection is at some point between the connections to source of




LOCATING GROUNDS IN CABLES.

current and fault. When the fault is passed, there will be no deflection on the galvanometer. This may be done in different manholes until the nearest two points which can be reached, between which the fault is located, are found.

If the fault should be located at a point in a duct between manholes or where the cable cannot be reached, the section between the two manholes or points where the fault has been located must be pulled out and the same galvanometer test made every few feet, as the cable is being placed on reel, until the exact point of the fault is located.

In case of a foreign current flowing in the lead sheath due to defective return conductors of street railways system, etc., there may always be a deflection on the galvanometer. In such cases the test current may be cut in and out during each test, and if the galvanometer needle swings, the testing connection is at some point between the source of the test current and the fault, if the deflection of the galvanometer is constant, the fault has been passed.

The Gerard method, using an induction coil and a telephone receiver, gives good results when the distance between the surface of the short-circuited conductors is not less than 5/16 of one inch. This method is not very satisfactory in places where the cable is located near an external and variable magnetic field, which will induce currents in the coil connected to the telephone receiver.

PITTSBURG, PA. GABRIELE D'EUSTACHIO.

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### WIRING AND MAINTENANCE OF SHUNT AND COMPOUND-WOUND MOTORS.

In the article on "The Wiring and Maintenance of Shunt and Compound-wound Motors," which appeared in your April 7 issue, the author's method of determining the size of wire necessary to feed a motor of a certain size is not strictly correct. The Underwriters require motors to have a name plate giving the maker's name, the capacity in volts and amperes, and the normal speed in revolutions per minutes. The motor leads or branch circuits must be designed to carry a current at least 25 per cent greater than that for which the motor is rated, in order to provide for the inevitable occasional overloading of the motor and the increased current required in starting without overfusing the wires; but where the wires under this rule would be overfused in order to provide for the starting current, as in the case of many alternating-current motors, the wires must be of such size as to be properly protected by these larger fuses. All that is necessary, therefore, is to note the rating in amperes on the name plate and install wires which will carry that amount of current plus at least 25 per cent overload, preferably more. Many motors, however, are rated in

horse-power, in which case the volts are given but not the amperes. It is necessary, therefore, in such cases to take into consideration the efficiency of the motor, and this is what Mr. Kavanagh overlooks, since his calculations are based on the assumption that the motor cited has an efficiency of 100 per cent, which is, of course, not true. The size of wire will, therefore, be too small. In the case cited by Mr. Kavanagh the wire with 25 per cent overload allowance would be No. 0 and not No. 3. The Underwriters inspectors have a quick method of determining the size of wire for a motor rated in horse-power. If the voltage is 110 and the motor is rated at 10 horse-power, the inspector multiplies 10 by 8 and increases the product 25 per cent, making the final number 100; he then refers to his table and notes that the proper wire is No. 1. If the voltage is 220, the multiplier is 4 instead of 8 and so on; so that if one has a 30-hp motor to be connected to a 220-volt circuit, it is only necessary to multiply 30 by 4, increase the product by 25 per cent, and find that a No. 00 wire will just pass. It would be better, however, to install at No. 000 wire in this case.

Newburgh, N. Y. C. N. Jones.

### PEAT AS FUEL IN CENTRAL STATION OPERATION.

At this time, when there is so much interest centered in the outcome of the negotiations between the coal miners and operators, we thought that it might be assuring to the public, and to the users of power especially, to know the progress recently made in the manufacture of peat fuel near Fond du Lac, Wis., by the Lamartine Peat, Light & Power Company. The first problem was to remove the peat from a submerged bog by machinery. This has been worked out by forcing down a steel cage 18 in. by 36 in. by 8 ft. long, which will remove one ton of peat every 60 to 90 seconds. The second difficulty was to get a machine to work the peat and bring out the binder or adhesive quality when worked in a wet state direct from the bog. One of the best makes of brick machine was installed, but no peat would pass through the die. Castings were moulded from different patterns and tried until the desired result was obtained, when the company got up an entirely new machine that will turn out 120 tons of crude peat in ten hours. The peat as it comes from the machine is placed on racks under open sheds for natural drying. The product contains about 10,781 B.t.u. and sold readily in the city of Fond du Lac last winter at $6 per ton for domestic use. This fuel can be manufactured f.o.b. at the plant for $1.20 per ton.

Fond du Lac, Wis. Lamartine Peat, Light & Power Co.

### SIX-PHASE POTENTIAL REGULATORS.

This is an account of a method, recently tried and found convenient, for selecting the proper primary terminals to be connected to the respective phases of the main six-phase circuit of a potential regulator in cases where the marks (if any) put on when the regulator was shipped from the manufacturers have

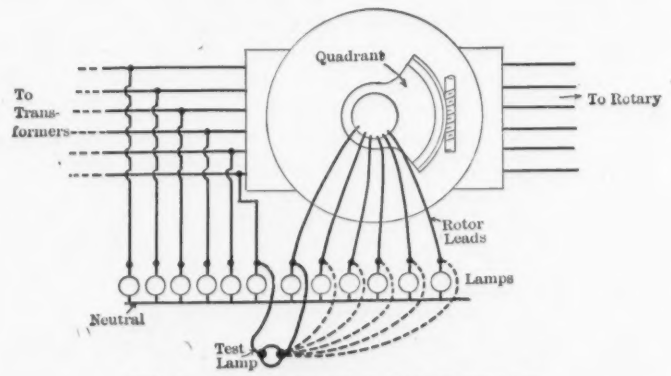


FIG. 1.—SIX-PHASE POTENTIAL REGULATOR.

been lost or defaced, as may occur in making changes in the original installation, moving apparatus to other locations, etc. The number of such cases which have arisen and the delay and trouble involved indicate the need of such a method.

The regulators referred to are of the "induction" type, commonly installed in connection with rotary converters and static transformers. The shunt or primary winding is on the rotor and the series or secondary winding is on the stator. The flexible

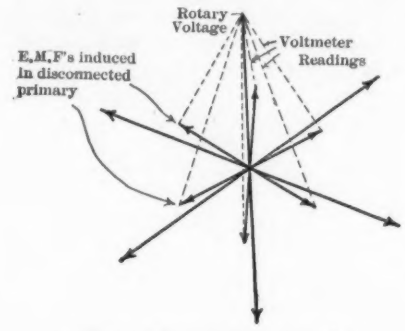


FIG. 2.—DIAGRAM OF E.M.F'S.

leads connecting the primary to the secondary may easily be traced through the windings in some types, showing their phase relation; in other types this is not the case, and it is with these latter types that this method of test is needed.

It is assumed that the rotary converter static transformers and the secondary of the regulator are properly connected to each other that the rotor is in place properly keyed to the quadrant by which it is to be turned; and that the six primary terminals, are disconnected from the main circuit.

In the method here suggested the procedure is as follows: Turn the rotor to either end of its travel. Suppose it is desired to make the end selected the "maximum boost" position, the other end of the travel being the "maximum lower" position. Insulate the primary terminals from each other and from the frame. Make a six-phase star connection of lamps of equal voltage and candle-power, as shown in Fig. 1. Connect the center of this star to the neutral of the system. If the rotary converter is being operated on a three-wire, direct-current system with a grounded neutral, it suffices to ground the center of the star. If there is no neutral one may be made either on the direct-current end or the alternating-current end of the rotary converter with lamps all of the same voltage and candle-power. Fig. 1 shows a neutral formed by another six-phase star connection.

With the primary coils of the transformers open, start the rotary converter from the direct-current end and run the machine

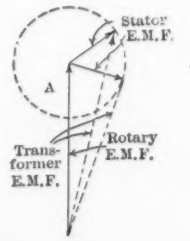


FIG. 3.—TRANSFORMER VOLTAGES IN DIFFERENT POSITIONS.

with full field and with all of the starting resistance in circuit, in order to obtain the lowest possible speed with full voltage on the armature. Exciting current now flows from the rotary converter through each phase of the primary winding of the regulator which is in circuit with a coil of the transformers. These small six-phase currents set up a rotating field in the regulator and the six-phase electromotive forces induced in the primary winding of the regulator will usually be high enough to light the lamps of the star connection. A diagram of these electromotive forces is given in Fig. 2. Connect an alternating-current voltmeter or a test lamp from one secondary terminal to each of the primary terminals in turn, noting the readings of the voltmeter or brilliancy of the test lamps. The dotted lines in Fig. 2 represent these readings and show their relative magnitude. The primary terminal giving the least voltmeter reading is the one to be connected subsequently to the secondary terminal chosen. Repeat this operation with each of the secondary terminals.

If the position in which the rotor is placed is to be made the "maximum lower" position instead of the "maximum boost," then substitute "greatest voltmeter reading" for "least voltmeter-reading" in the above directions.

Now bring the rotary converter to rest, and connect the primary terminals properly to the secondary terminals. During normal operation with the rotor in the "maximum raise" position, the direct voltage should be a maximum for a fixed transformer voltage; but in this test the direct voltage is fixed so that the transformer voltage is a minimum when the rotor is in the "maximum raise" position and should rise continuously as the rotor is moved toward the "maximum lower" position. Suppose that it first decreases a small amount before beginning to increase. Note the distance the quadrant has traveled when the actual minimum alternating voltage occurs; if it has moved less than one-sixth of its whole travel, then the only remedy is to move the quadrant back to its "maximum raise" end, keeping the rotor in the position of actual maximum raise; this of course would require a change in the keyways on the rotor shaft and quadrant. Fortunately the defect is usually small enough to be neglected. If the above distance is between one-sixth and one-half of the whole travel, shift each primary terminal to the next secondary terminal toward the "maximum raise" position; that is to say, if the rotor turns clockwise in going from "maximum lower" to "maximum raise," then the primary terminals should be shifted clockwise; the primary terminal originally on the clockwise end is put on the counter-clockwise end, that is each terminal is shifted one phase clockwise.

This rule assumes that the secondary terminals are in the same relative position as their respective coils, which is usually true.

If this trouble occurs at the "maximum lower" end instead of the "maximum raise" end, substituting "lower" for "raise," "maximum" transformer voltage for "minimum," etc., in the above directions.

The above distance will not be as much as one-sixth of the travel if due care is taken in the original test.

The effect of the defect is to cut off part of the range, as is shown in Fig. 3. If the line, *H*, is made equal to the alternating rotary voltage and the radius of the circle is made equal to one half the range, then the dotted lines are equal to the transformer voltages in the different positions.

The quadrants are usually built to give not more than 90° rotation in space, in a 4 pole regulator, which is the common type, corresponding to 180 electrical degrees and to 180° rotation of the radius in Fig. 3. Hence if the actual maximum occurs before the end of the quadrant is reached, part of the range at the other end of the travel is lost.

NEW YORK. HUMPHREYS MILLIKEN.

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### THE SOLUTION OF A PROBLEM IN CHIMNEY CAPACITY.

Some months ago the writer had occasion to install a boiler of 248 rated horse-power in a contracted space in a large manufacturing building, where the stack capacity was inadequate. The conditions were so unusual that it was doubtful whether successful operation of the boiler could be attained, although calculations indicated that it would. A Worthington water-tube boiler having a grate area of 65.35 square feet and a heating surface of 2,226 square feet was employed and was fired through three doors from the side. The boiler room was located under the sidewalk, and after the boiler was installed there was only enough room left for stoking and for a six hours' supply of coal. There was absolutely no means for ventilating the space. The area of the stack was 19 in. by 19 in., while the smoke opening at the top of the boiler, which was properly designed, was 26¼ in. by 9 ft. Some form of forced draft had to be employed, but to apply the draft under the grates would have been useless. The constricted stack area would force the gases in the fire-box through the fire door and out into the boiler room which would, of course, become uninhabitable; and the fire front and doors would become warped and cracked by the flames. Induced draft had to be rejected on account of the peculiar space conditions. The only available spot in which to locate the blower was also used as a cold storage room and the heat from an induced draft blower was therefore prohibited.

It was finally decided to make the boiler room air-tight and to force air into it with a steel plate fan. A direct-driven steel plate fan 4 ft. x 22½ in. equipped with a Ford regulating valve, was successfully employed. The cold-storage room was made cooler by the fan which drew cool air from without through the room. This was forced into the boiler room, making the heat in front of the boiler endurable. The boiler being under a pressure varying from three to five and one-half inches of water, no gases could escape into the boiler room; everything was forced up the stack. It was found possible to burn enough fuel under these conditions to obtain from the boiler a little over 300 nominal horse-power. The fire burned normally, and was such as would be expected with an ordinarily good stack having a draft of about ¾ in. The difference in pressure between the boiler room and the stack breeching in all probability did not exceed this figure. The difference in pressure between the products of combustion in the stack and the outside atmosphere was considerable, as was evidenced at the top of the stack where the gases shot some 10 ft. into the air before being carried away by the winds. It was also found that owing to leaks in the stack the surrounding rooms were quickly filled with the products of combustion, so that the stack had to be carefully gone over, the leaks stopped, and the stack sheathed. It is not the intention of the writer to recommend the foregoing as good engineering. It is simply an expedient into which he was forced by the conditions. The installation was of a temporary character and will probably remain for only a year or two pending the construction of a larger and modern boiler room. The stack which was employed was built into the walls of the building and could not be enlarged, nor could a new one be constructed without great expense which the owners did not think justifiable.

NEW YORK. G. T. HANCHETT.

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### A COMMON FAULT IN POWER PLANT DESIGN.

The study of electrical power plant design is always a matter of interest to the engineer whose practice lies in the central station or isolated plant field. A careful analysis of the conditions surrounding each new installation generally suggests arrangements worthy of both imitation and avoidance, because the choice and disposition of equipment is in at least nine cases out of ten a compromise between conflicting requirements. In few plants are conditions duplicated, and methods undesirable in one may not be contrary to good practice in another; but with a clear understanding of the reasons governing a particular design much may be learned as to the proper course in other cases.

As a general rule, the practice of operating incandescent lamps and large motors upon the same bus-bars is of doubtful wisdom, and in view of the years of operating experience upon which designers of power plants may build, it is certainly surprising that so many defective installations are still in vogue. In some recent office building designs, the conditions in this respect are so bad that only the corridor lamps can be supplied by the plant on the premises, the fluctuations of half-a-dozen electric elevators rendering it necessary to resort to central station current. The load factor of the plant in such cases is largely a matter of the afternoon or evening peak, and the economies of operating on a good all-day average output are missed entirely. The relative costs and advantages of isolated plant versus central station service furnish the basis of a ceaseless discussion; but when an owner has committed himself to either plan, there is no doubt that the broadest economy lies in making the most of the means at hand. To divide the load between a power plant on one's premises and the local central station is therefore objectionable from the standpoint of efficient operation, for it means a large investment in idle equipment throughout the greater part of each day.

In a recent isolated plant installed for restaurant service, the lighting is worked out by the use of 16-cp 220-volt lamps, about 500 being connected to the circuits. Only one motor is used with the exception of fans in the summer season, but this motor is of 15 hp rating and it drives a freight elevator which is in constant

use. As there is no separation of circuits it naturally follows that every time the motor starts the lamps flicker slightly on account of the momentary drop in speed of the engine and the consequent drop in voltage together with the rapid cooling of the thin filaments in the bulbs. The motor requires 40 amperes in starting under load and the voltage drops about 5 points each time the elevator is moved. Five volts in 220 is only about 2.3 per cent, but with the sensitive filaments used in 220-volt lamps this is enough to render the quality of light poor.

The generating plant consists of two machines rated respectively at 35 and 25 kw, and ordinarily the smaller one is operated in the daytime, the larger unit being held in reserve to handle the evening peak. Both dynamos feed a common pair of bus-bars, and the regulation is good as the load changes, the temporary fall in speed as the elevator is started lasting but a fraction of a second—just long enough, in fact, for the voltmeter to swing backward 5 volts and return to its original position. With 110-volt lamps the flickering would scarcely be noticed, but the use of 220-volt filaments is a different matter.

In the modern restaurant the attractiveness and steadiness of the lighting is an important factor in the retention of custom and no establishment of this kind can really afford to maintain lamps of irregular brilliancy.

In the case under consideration, the remedy is not far to seek. Considering the peak loads of restaurant "traffic," it would hardly pay to install a storage battery in this instance, or to rearrange the switchboard wiring to separate the loads. The simplest plan would naturally be to limit the hours of operation on the freight elevator; but as this is hardly possible it should be an easy matter to run leads from the elevator motor to the idle unit, disconnecting this unit from the switchboard and lighting circuits during the hours that the restaurant load is heaviest. As the elevator is in constant service the load upon the otherwise idle unit would be tolerably even and the advantages of thus smoothing out the flickering by supplying the light and motor loads from separate machines would be sufficient to establish thoroughly good service in all parts of the restaurant. To a certain extent the remedy is a makeshift, but in small plants the operation of lighting and power loads on the same bus-bars is never ideal practice

Boston, Mass. James K. Reid.

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### ROTARY CONVERTER COMMUTATORS.

In the sub-station of to-day the operation of the rotary converter is of prime importance, as it is the connecting link between the alternating-current transmission system and the local direct-current distribution. Perhaps the most important points, requiring consideration in the operation of the rotary converter, are the care and vigilance necessary to keep the commutator in a condition consistent with the proper performance of its duties and with the maintenance of the general appearance of the installation of which it is a vital part.

Many papers have appeared in the electrical journals from time to time, treating of the commoner causes of commutator troubles, particularly those met with in the operation of motors and dynamos, such as unequal wearing of copper and mica, eccentrical commutator, unequal magnetic distribution, coils open or short-circuited, excessive voltage, vibration, and so forth, but little has as yet been written upon the care of rotary converter commutators in particular.

No attempt will be made to demonstrate the superiority of carbon brushes over those of copper as brushes of the latter type are entirely out of place in a rotary converter installation. The bad effects due to accidents, such as cutting a rotary in out of step, short-circuits and so forth, and also hunting, will be omitted for obvious reasons.

That cleanliness is a very important factor in sub-station maintenance is universally acknowledged by operating engineers, and it is safe to assert that nowhere else will the records show such large returns as for the time and patience spent on keeping the commutator clean.

The equipment of every sub-station should include an air compressor capable of maintaining a pressure of 60 lb. to the square inch, or more at the nozzle and should be motor operated, with the switches and starting box located conveniently for the operator.

At the end of each run the rotary should be thoroughly cleaned out by means of the air compressor, special care being taken to free the brushes and holders from the copper and carbon dust accumulated during the run.

In mixed sub-stations, that is, in stations with apparatus other than the rotary converter and its accessories, the practice of covering the rotary with a tarpaulin or other covering, cannot be too highly commended, but in the pure sub-station the aim should be to keep the station and apparatus so clean and free from dust that a covering would be entirely unnecessary.

While a strict regard for cleanliness will without doubt win half the battle, there are still a few other particulars which have to be taken into account before one can expect the commutator to operate entirely satisfactorily.

Very frequently the carbon brushes are themselves the cause of trouble, and extreme care should be taken in the selection of the brushes to see that all are of a uniform quality. Perhaps the best method of checking their selection is to watch the rate of wearing away of those brushes which have been put into service at the same time and under similar conditions. An examination should be made of all those which appear to wear at a slower rate than the average, and all brushes having a hard glazed surface or those badly pitted should be discarded.

At regular and frequent intervals the brushes should be sandpapered to remove any unevenness caused by inherent sparking, hard spots or other causes, and to provide a good bearing surface on the commutator.

The usual and perhaps best way of doing this is to slip a piece of sandpaper under the brushes without disturbing the tension springs, and with the plain side of paper pressed against the surface of the commutator, move the paper backward and forward in the direction of rotation of the commutator until assured of a good contact between the two surfaces.

Another very common cause of trouble—a sticky commutator—should be guarded against by keeping all parts of the machine clean, as already mentioned, and by restricting the use of commutator compounds to those known from experience to be harmless.

That the relative distribution of the positive and negative brushes over the surface of the commutator is largely responsible for the grooving of the commutator has only lately been proven.

The general practice in most sub-stations has been to stagger the positive and negative brushes so that the spacings between the several brushes of one polarity mounted on one holder are in line with the centers of the several brushes of opposite polarity mounted on the next holder. The intentions are to have the brushes so placed that the entire width of the commutator is subject to the wear of the brushes.

The above arrangement, together with a suitable amount of end play, would seem to be the ideal condition, and would be but for one reason. It is apparent that the brushes of like polarity are all in line; in other words, the positive brushes would tend to wear a series of rings, or grooves, in the commutator entirely distinct from those made by the negative brushes. Now, it is found in practice that while the brushes of both polarities are operating under like conditions, that at the point where the current leaves the commutator, or under the positive brushes, the commutator is worn at a greater rate than it is at the negative brushes.

The solution of this problem is to stagger the positive and negative brushes in pairs, and distribute the pairs evenly over the surface of the commutator; that is, in a six-pole machine there would be three pairs or sets of brushes, each pair consisting of a positive holder with its several brushes and a negative holder with its brushes, each brush of one polarity having a brush of the opposite polarity exactly in line with it.

It is safe to assert that with a reasonable amount of care combined with the proper arrangement of brushes, and with a slow oscillating motion of the armature produced by an efficient end play device, that the heart of the rotary converter attendant will be gladdened by the presence of that bluish, or bronze glazed surface on the commutator which is so pleasing to the eye of the engineer.

Riverton, Wash. A. B. Case.

# QUESTIONS AND ANSWERS.

If I take a standard 220-volt motor and feed it with a variety of voltages from a balancing transformer, say 40, 80, 110 or 160, would this damage the machine and would the machine give the same horse-power at the different voltages? J. T. S.

You cannot obtain the same output from a 220-volt motor by reducing the voltage without correspondingly increasing the amperage, and to increase the latter means the destruction of your motor. The output will vary practically directly with the voltage.

We have a generator which has been shipped to us in an open car and which we believe has collected considerable moisture. Would there be any danger to the armature if the machine was started up at once at full potential? C. S. C.

Separately excite the generator with a weak current and run at a very low speed with brushes short-circuited. A large current at a low potential may thus be obtained which will dry out the armature in a few hours. Care should be exercised, however, not to permit this current to exceed the normal current of the machine.

Is alternating or direct current more fatal in its results, and what voltage is required to kill a human being? H. W. W.

Although alternating current is used for capital punishment, the effect of either alternating or direct current at ordinary voltages is practically the same. A sudden shock from either may suspend the animation or kill, but death from physiological action depends only on the current passing. Different individuals may withstand different current strengths, and the amount of current passing will depend upon the resistance of that portion of the human body in direct circuit, which resistance is largely localized at the surfaces of contact. This resistance may vary from a few hundred ohms to many thousand ohms, and for a fatal current the voltage will vary correspondingly.

What solution is used for nickel-plating and what would be the voltage of the supply? W. M.

The solution used in nickel plating is the double sulphate of nickel and ammonia. Twelve to sixteen ounces of this is dissolved in pure boiling water in a clean wooden vessel. After the solution has cooled, water is added until the density is about 1.03 to 1.06. The solution should be slightly acid or neutral. It will be necessary to add ammonia from time to time to replenish the solution when it is in use. From 3.5 to 6 volts is the potential required and .3 to .65 amp. per sq. ft. of plating surface. Inasmuch as the solution is denser at the bottom than at the top, it will be necessary to reverse the plated article when the operation is about half completed, or else suspend the plated article longitudinally.

A central station supplies its customers with three-phase four-wire 50-cycle current at a normal secondary voltage of 25 volts between any phase and the neutral wire. Practically, however, the voltage varies between 119 and 106 volts, but generally it is between 128 and 134; 133-volt 3.5-watt lamps are used so as to give a reasonable life. Half of the time, of course, these lamps give an unsatisfactory light. The central station people will do nothing to keep the voltage steady. Could not a simple and not very expensive device be installed on the premises of two consumers which would keep the voltage steady on their premises? If so, where could such apparatus be procured and of what would it consist? A. H. B.

We do not know whether there is such a regulator as you desire manufactured or in use. One could, however, be made, employing a principle similar to that employed in the Tirrell regulator, only that instead of regulating the voltage of a generator by varying the field strength the regulator would vary the delivered voltage by varying the circuits of a transformer.

What is the voltage, size of wire and length of the longest power transmission circuit? (b) What is the length, voltage and size of wire of the highest voltage power transmission line? (c) What would be the necessary size of wire and the most economical voltage for a transmission line 250 miles long? W. W. W.

The longest transmission line runs from De Sabla to Sausilito by way of Cordelia, Cal., and is 232 miles long. The potential of this line is 60,000 volts, and the wire used is No. 00 hard-drawn copper, with a duplicate line of No. 0000 7-strand aluminum wire. This is not, however, a single line between two points. The longest continuous transmission line is from Necaxa to El Oro, Mexico, and is 171 miles long. The potential of this line is also 60,000 volts, and the conductor is 6-strand copper, ½ inch in diameter. We do not know of any transmission line working at a higher potential than 60,000 volts. The size of wire and the most economical voltage for a transmission line 250 miles long will depend upon the amount of energy transmitted, the cost of generating the energy, the price at which it is sold, the fixed charges and other factors.

I have a compound-wound generator running and wish to throw another compound-wound generator in multiple with it. What is the proper procedure, and when both are running, how should one be shut down? E. N. N.

If one compound-wound generator is running and it is desired to place another in multiple with it, the procedure is as follows: Bring this latter machine up to speed and adjust its voltage as near as possible to the voltage of the other machine. Then throw in its circuit-breaker and close the three-pole switch. Note the ammeter reading to see whether the load is properly proportioned or not. If the other machine is taking too much load, throw resistance into its field regulator, or cut resistance out of the regulator of the machine just started. If this latter machine takes to much load, throw the regulators in the opposite direction. When cutting out one of the compound-wound generators, it will be necessary to throw in resistance in its field circuit until the load is very small. The circuit-breaker may then be opened, and then the three-pole switch, after which the engine may be stopped.

What is the action of the starting coils of the Holtzer-Cabot single-phase induction motor, and how do these determine the direction of rotation? R. H. S.

The Holtzer-Cabot motors are brought up to speed by an operation known as "splitting the phase." The stator is wound with two sets of coils, one known as the working coils and consisting of comparatively few turns of heavy wire which are in circuit continuously, and the other known as the starting coils. Current is simultaneously thrown on both sets of coils in parallel, and by reason of the difference in the self-induction, the currents in the two sets of coils will be out of phase with each other. The result is a sort of rotating field, and the rotor is dragged around with accelerating velocity until it attains normal speed, when the starting coils are cut out of circuit. The direction of rotation is dependent upon the mechanical position of the starting coils and the polarity sequence, the rotor revolving in a direction from that portion of a pole not surrounded by a shading coil toward the shaded side of the pole, or in other words, if the shading coil obtains a like polarity as the working coil but after the working coil, the rotor will revolve in that direction.

We would be obliged if you would inform us wherein the Burke three-wire generator differs from the three-wire generators already on the market. J. E. L. Co.

The three-wire generators on the market are provided with four collector rings in addition to the regular commutator and the leads from the collector rings are brought to two balancing transformers to which the neutral of the three-wire system is connected. In the Burke generator there is only a single collector ring besides the ordinary direct-current commutator, and the balancing transformer is incorporated in the armature winding. This auto-transformer, or so-called choke coil, is connected between certain points on the armature windings separated by 180 electrical degrees. The central point of this coil will maintain a mean potential between the positive and negative terminals of the machine. Connection to the central point is made with the slip ring. If it is desired to operate generators of this type in multiple it is necessary that the series coils be connected in both the positive and negative circuits. One-half of the series field turns is joined in circuit with the negative lead and the other half is connected with the positive lead. If it is desired to properly join the several sections of the series coils of the individual generators in parallel it will be necessary to connect five main cables from each generator to the switchboard.

# CENTRAL STATION SALE OF CURRENT

## USES FOR CENTRAL STATION SERVICE.

The following list of uses for electric central station service has been compiled for the convenience of the numerous central station companies which are at the present time preparing to get actively after new business. In organizing a new business campaign it is, in the majority of cases, necessary these days for a central station company to start with solicitors who have had little or no experience in the central station business. It is important, therefore, at the start to be able to place before them in definite form a fairly complete list of the possible uses of central station service in the various lines of business. It is also of value for the central station manager himself to glance occasionally over a list of this kind because it is likely to remind him of possible customers in his town who have been overlooked. It is important that the man going after new business, whether he be a manager or a solicitor, should have before him a clear idea of all the possible applications of electricity to be presented to the prospective customer.

In compiling this list ordinary lighting has been considered as a matter of course and not included; and for the same reason no attempt has been made to enumerate all the kinds of machinery that may be driven by motors in the various industries which employ numerous machines requiring power. Such an enumeration would add uselessly to an already long list. For example, in a machine shop or laundry it is unnecessary to enumerate all the machines that may be driven electrically, as even a novice at the business would naturally work to secure the operation by electric motors of all the machinery in any institution using considerable power. In cases where the possible chances for the use of central station service are likely to escape the attention of the inexperienced, the list goes more into detail in order that no points may be overlooked in determining possibilities. Although this list is doubtless incomplete, it is perhaps the fullest yet published, and is particularly adapted for practical use. It has been compiled from a number of different sources, including the lists of customers of several central stations and the lists provided for solicitors by the new business departments of several companies.

### AUTOMOBILE AND BICYCLE SHOPS.

- Tire pump motors.
- Electric automobile charging.
- Charging spark storage batteries.
- Heating vulcanizer.
- Motors for machine tools.
- Electric soldering irons.
- Enameling ovens.

### BAKERIES.

- Motor-driven dough kneaders.
- Motor-driven ice cream freezer.
- Motor-driven biscuit cutters.
- Motor-driven candy mixers.
- Motor-driven revolving ovens.
- Fans.
- Ovens electrically heated.
- Shredded candy machines.

### BANKS, EXPRESS AND RAILWAY OFFICES.

- Elevators.
- Fans.
- Motors for coupon cutters.
- Sealing-wax heaters.
- Ticket stampers.

### BARBER SHOPS AND HAIRDRESSING PARLORS.

- Vibrators for massage.
- Electric hair dryer.
- Fans for cooling or drying.
- Cigar lighter.
- Shoe polisher.
- Nail polisher.
- Sign and display lighting.

### BLACKSMITH SHOPS.

- Motor-driven forge blowers.
- Motor-driven trip hammers.
- Motor-driven drills.
- Motor-driven emery wheels.

### BOOK BINDERIES.

- Motor operation for all machines.
- Fans for cooling or drying.
- Fans for ventilating.
- Electrically-heated glue pots.
- Electrically-heated lettering irons.

### BREWERIES AND BOTTLING WORKS.

- Motor-operated machinery.
- Motor-driven air compressor.
- Bunghole lamps for keg interiors.

### BUILDERS AND CONTRACTORS.

- Electric lighting during construction.
- Motor-driven hoists.
- Motor-driven excavating machinery.
- Motor-driven stone dressers.
- Motor-driven stone crushers.
- Motor-driven concrete mixers.
- Motor-driven floor planers.
- Motor-driven saws.
- Floor polishers.

### CHEMISTS AND ASSAYERS.

- Electrolytic work.
- Electric-furnace work.
- Electric heating for chemicals under analysis.
- Annealing furnaces.

### CHURCHES.

- Fans to assist in cooling or heating.
- Organ blower.

### CLOTHING AND TENT FACTORIES.

- Electric flat irons.
- Motor-driven cloth cutters.
- Motor-driven sewing machines.
- Ventilating fans.

### DRUG STORES.

- Electric cigar lighter.
- Sign and display lighting.
- Fans for ventilating and for keeping frost from windows.
- Motor-driven centrifuge.
- Motor-driven shakers for soda fountain.

### DRYGOODS AND DEPARTMENT STORES.

- Advertising signs.
- Window display lighting.
- Show-case lighting.
- Electric elevators.
- Ventilating fans.
- Motor-operated cash-carrier systems.
- Fans for keeping frost from show windows.

### ELECTROTYPERS AND ENGRAVERS.

- Electric furnace.
- Current for electrotype bath.
- Arc lamps for photo engraving.

### FARMS, GREENHOUSES, DAIRIES, ETC.

- Electrically-heated incubator.
- Motor-driven feed chopper.
- Motor-driven corn sheller.
- Motor-driven churn.
- Motor-driven cream separator.
- Motor-driven ice machine.
- Electric pumps for general water supply.
- Fly and ventilating fans.
- Lighting of stables.
- Lighting of greenhouses.
- Lighting of chicken houses.
- Irrigating pumps.
- Motor-driven food mixers.
- Arc lamps over oil tanks for bug extermination.
- Incandescent lamps for bug extermination.

### FIRE ENGINE HOUSES.

- Motor-driven horse groomers.
- Motor-driven horse clippers.
- Pumps.
- Hoists.

### FOUNDRIES.

- Fan blowers.
- Emery grinders.
- Rattlers.
- Mercury vapor lamps.
- Flaming arc lamps.

### GROCERIES.

- Coffee grinding.
- Motors and electric heat for coffee roasters.
- Egg candlers.
- Fans for cooling and preventing flies.
- Fans for keeping frost from windows.
- Motor-driven refrigerator machine.
- Display and sign lighting
- Elevators.

### HARDWARE AND TIN SHOPS.

- Motor-driven punches.
- Motor-driven drills.
- Motor-driven grinders.
- Motor-driven rolls.

### HARNESS AND LEATHER GOODS MAKERS.

- Sewing machine motors.
- Pyrography burners.

### HOTELS AND RESTAURANTS.

- Display and sign lighting.
- Refrigerating plant.
- Compressed air and vacuum cleaning apparatus.
- Motor-driven ice-cream freezers.
- Plate warmers.
- Electric broiling and toasting tables.
- Fans.
- Chafing dishes.
- Coffee percolators.
- Automatic pianos and music boxes.
- Curling iron heaters
- Additional bedroom lighting, portables, etc.
- Dumb waiters.
- Elevators.
- Motor-driven dish-washing machine.
- Dough mixers.
- Laundry machinery.
- Ventilating fans.
- Cigar lighters.

### ISOLATED ELECTRIC LIGHT PLANTS.

- Operation by central station during light load periods.

### JEWELERS.

- Motor-driven lathe.
- Electroplating.
- Electrolytic reduction of metal.

### LAUNDRIES.

- Motors for operating all machinery.
- Ventilating fans.
- Drying fans.
- Electric irons.
- Electrically-heated rolls.

### LIVERY STABLES.

- Motor-driven horse groomer.
- Motor-driven horse clipper.
- Fans.
- Carriage elevators.
- Pumps.

### MACHINE SHOPS.

- Motor driving for all machinery.
- Electric welding machinery.
- Electric hoists and traveling cranes.

### MEAT MARKETS.

- Motor-driven meat grinder.
- Motor-driven refrigerating machine.
- Fans.

### MINES.

- Electric hoists.
- Electric drills.
- Motor-operated gold dredges.
- Motor-operated mills and reduction works.

### MISCELLANEOUS OFFICES.

- Fans.
- Addressograph motors.
- Motor-driven adding and tabulating machines.

### PAINT AND VARNISH MAKERS.

- Electric heating for inflammable substances.
- Motor-driven grinding and mixing machinery.

### PHOTOGRAPHERS AND BLUE PRINTERS.

- Arc and mercury vapor lamps for portrait work.
- Arc and mercury vapor lamps for enlarging.
- Fans for rapid drying.
- Arc and mercury vapor lamps for printing.
- Incandescent lamps for dark rooms.
- Motor-driven circular blue print frames with arc lamps.

PHYSICIANS, SURGEONS, DENTISTS, AND HOSPITALS.

Heating pads.
Sterilizers electrically heated.
X-ray machines.
Apparatus for light treatment.
Vibratory massage.
Electric needles.
High frequency electrotheurapeutic apparatus.
Fans.
Hot-air apparatus.
Electric furnace for dentists.
Dental motors.
Cooling of fever patients by fans blowing against wet sheets.

PLANING MILLS AND WOOD WORKERS.

Motors for driving all machinery.
Fan blowers.
Glue-pot heaters.
Steaming lumber.

PLATING WORKS.

Motor-driven plating dynamo.
Motor-driven burnisher and polisher.

PRINTING AND NEWSPAPER OFFICES.

Motor-driven presses.
Motor-driven paper cutters.
Motor-driven plate saws.
Fans for ventilating and drying.

RAILWAY INTERLOCKING PLANTS.

Electric lighting of switch and semaphore signals.
Power for electric and electro-pneumatic switches and signals.

RENOVATING WORKS.

Motor-driven compressors for compressed air cleaning.
Motor drive for all machinery.

RESIDENCES AND APARTMENTS.

Heating Devices.

Flat irons.
Heating pads.
Curling iron heaters.
Chafing dishes.
Coffee percolators.
Egg boilers and light cooking devices for apartments
Heavy cooking devices for kitchens.
Sealing-wax heater.
Hot needle for pyrography.
Cigar lighter.
Nursery milk warmer.
Pantry plate warmer.
Electric radiator.
Warm rug.
Foot warmer.

RESIDENCES AND APARTMENTS.

Additional Lighting.

Portable lamps.
Porch lamps.
Private yard lamps.
Stable lamps.
Tennis court lamps.
Decorative lighting for special occasions.
Lamps mounted on dressers.
Shaving mirror lamps.

RESIDENCES AND APARTMENTS.

Motor Applications.

Fans for cooling in hot weather.
Fans to force circulation and increase heating capacity of radiators in winter.
Fans over hot-air registers to help furnish circulation.
Fan in cold-air pipe of hot-air furnace to force circulation to entire house.
Fans to hasten drying in laundry.
Motor for ice-cream freezer.
Water pumping.
Motor-driven horse groomer in stable.
Motor-driven pump for vacuum or compressed air cleaning.
Refrigerator ice machine motor.
Sewing machine motor.
Washing machine motor.
Dumb waiter.
Automobile tire pump.
Organ blower.

SALOONS.

Decorative and display lighting.
Air compressors for pumping beer.
Refrigerating machinery.
Fans.
Cigar lighters.
Shakers.

SAW MILLS.

Motor operation of all machinery.

TAILORS, HATTERS AND CLEANERS.

Electric pressing irons.
Sewing machines.
Cloth cutters.
Hat burnishers.
Blockers.
Hat cleaners.
Fans for drying.
Washing machines.

TELEPHONE AND TELEGRAPH OFFICES.

Motor generator sets.
Fans.

THEATRES AND HALLS.

Motor-operated curtains.
Motor-operated scene shifters.
Electric signs.
Additional lighting.

## Starting a New Business Department.

BY W. H. WINSLOW.

There is one point which the manager of a central station who intends organizing a new business department should carefully consider before adopting any so-called system. This is that the size of and local conditions affecting his station must determine largely the methods to be employed. In considering this question it will be advisable to divide central stations into three classes, each of which demands quite a different treatment of the new business problem, and, incidentally, of many others as well.

First, there is the very small or "one-man" station. Here any elaborate system of records, however good in itself, is likely to result in a waste of time which could be better employed in good plain "hustling." This must not be understood as meaning that the man in charge of a very small plant should not go after business systematically, but merely that his system should be a very simple one. All he needs is one of the outfits consisting of a pocket case containing cards 3 by 5 in. in size, with guide cards for the days of the week and a desk tray with daily and monthly guide cards. This equipment will enable him to see his "prospects" regularly and take almost no time to keep up. While blank cards will answer very well, quite a saving of time will result from having them printed with a form similar to Fig. 1. The back of the card can be used for memoranda of estimates given on cost of wiring, power, etc. It is not likely that he will conduct much of a mail campaign, or that such a course would be advisable. He should, however, distribute such circulars advertising electric cooking and heating utensils, turn-down

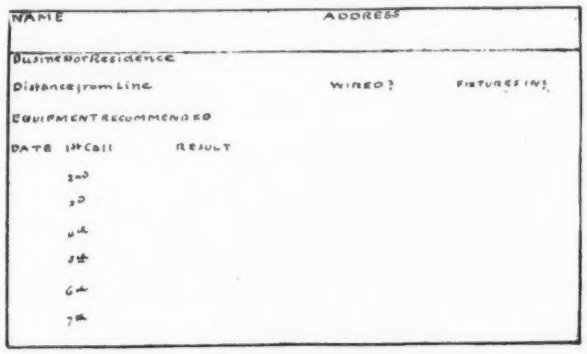



FIG. 1.—GUIDE CARD.

lamps, motors, etc., etc., as can be obtained without cost from manufacturers, and while many of these can be left when he makes his calls, it is suggested that he occasionally mail them, using his cards as a mailing list.

At the opposite extreme from the "one-man" plant is the very large station where a very elaborate system of records is necessary and where one or more men (in addition to the field force) give the new business department their undivided attention.

Between these extremes lie, perhaps, the majority of plants, the stations which are neither very large nor very small, "between a horse and a pony," as the old saying is; where no one man can carry all of the prospects under his hat, and yet where a regular department is out of the question. This third division should, as a matter of fact, be again subdivided, and it is in this class that mistakes are most likely to be made. On the one hand, the rather small station is apt to adopt a system which, as has already been suggested in these columns, is so elaborate and requires so much time that it will be a failure because it will not be kept up. On the other hand, the comparatively large station may fail to get the best results because its data are not complete and its

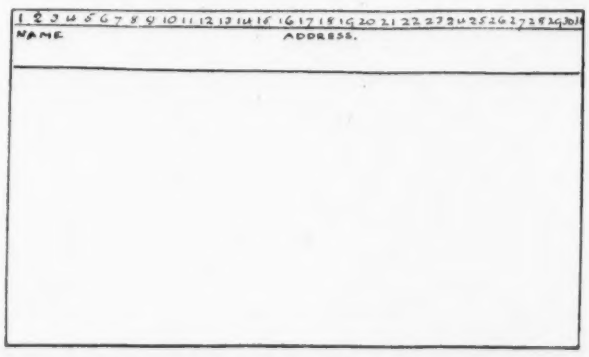



FIG. 2.—CARD INDEX OF PROSPECTIVE CUSTOMERS.

prospects are not seen frequently enough. Disregarding all variations in local condition, however, there are a few underlying principles that apply to all alike. There is nothing like personal solicitation to get results and a beautiful office system without good solicitors will be a failure, more or less, while good solicitors will get results even with no system whatever. Unquestionably, however, this combination of good men guided and

directed by a simple but efficient office equipment and backed up by a thorough follow-up system by mail is the only true method.

As involving the least clerical labor and therefore the greatest likelihood of being properly kept up, the following is suggested as a modification of the follow-up system outlined in an editorial in the monthly edition of the Electrical World for February.

First, an alphabetically kept card index of prospects, the cards to be numbered across the top from one to thirty-one (see Fig. 2) and bearing aside from this only name and address. By placing projecting metallic markers on the cards over the desired date, all prospects demanding attention on a given date can be at once located. Second, a series of manila folders, also alphabetically filed (Fig. 3) to be used as described in the editorial referred

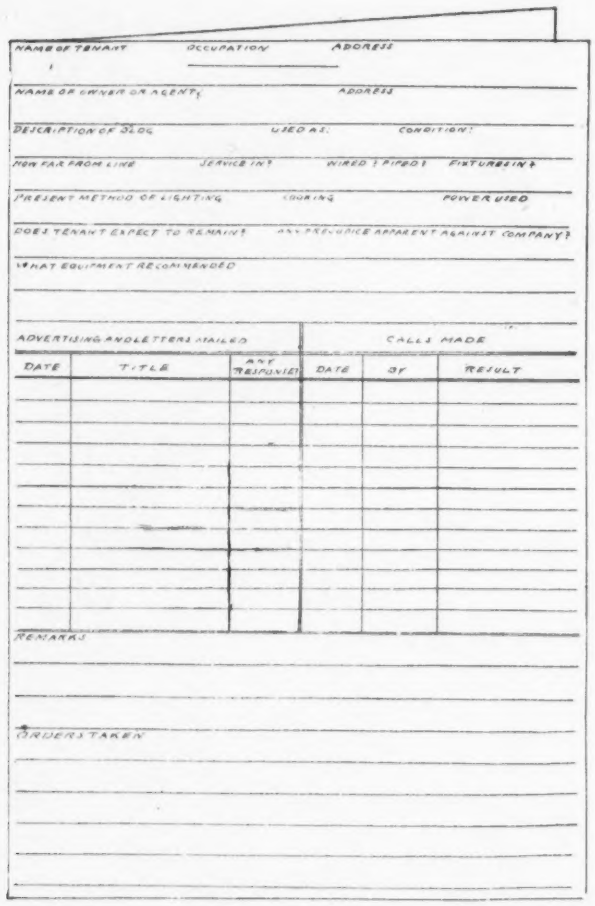



FIG. 3.—FILE WRAPPER.

to, but having printed on the front a blank for such information as is desired, including the record of form letters and advertising matter sent, visits made, etc. It will be observed that this differs from the original plan in having all of the information in or on the folder, while the card record is a simple index and "tickler." The following will make clear just how the outfit is handled:

The files containing the cards and the folders are placed side by side on a desk and the first card bearing a marker over the current date lifted up far enough to reveal the name; the folder bearing the same name is then removed from the file and placed face downwards on the table; next the marker on the card is moved to the next date on which the prospect is to be approached, and the card pushed down into place. When this has been done with all the cards bearing markers over the current date, the folders are used as a mailing of "calling" list, proper notations made or copies of letters attached and the folder restored to its proper place in the file. Metal markers of different colors may be had so that if it is desired to keep separate the mail follow-up and the personal solicitation dates, the same card index may be used for both, each card bearing two markers.

# The Over-Advised Central Station Manager.

By John Craig Hammond.

Pity the poor central station man. He is a victim of "advice," "suggestions," "expert knowledge" these days. "Do this; this is the way to increase your business." "Ah, no; that is not the way; it's this way." "Do it that way? No, my dear victim, not that way, but this way."

This is not in any way an attack on the methods of "expert advisers" in the advertising world—not in the least—rather it is an appeal to the central station man to do a bit of thinking on his own "hook." It goes without saying that advertising has become one of the arts. The average central station man has not the time or knowledge to properly carry on his advertising. But should he advertise? The "experts" with one voice will say yes. That does not make it so.

Here is the situation to-day in a few words: The average central station man wants to increase his business if he can. Henry L. Doherty was one of the first central station men to demonstrate it could be done by new business methods, and by advertising. Mr. Doherty made a study of advertising—he secured the advice of experts and when he did not like the advice of the "experts" he made it his business to point out where and why they were wrong. Every central station man cannot do what Mr. Doherty accomplished. The reasons are many.

The success of Mr. Doherty's efforts started the ball rolling; "advisers" came to the front by the score.

"If Doherty can do it, we can; we will follow his tip," was the comment of other central station managers and in the end they employed "experts." The "experts" worked on the theory that all cases were alike. They discovered that this was not true—the central station man paying for the knowledge.

One by one the "victims" were gathered in and "advised." Some grew weary of advice—gave it up and declared advertising was a failure. They were wrong. Advertising, if properly carried on, is a success.

The central station man must buy machinery. He buys other equipment, then he has to supply electricity to the consumer. There you have the start—what's it costing him to deliver a kw-hour?

He must sell electricity at a profit—he wants to sell all he can make. His demand under normal conditions is so much—if he could get other consumers he could increase his gross income, say, $50,000 a year.

The advice expert will outline a campaign—he will say that a year's campaign on the follow-up principle will cost so much. The cost, say, is $5,000 to $50,000 a year—more for larger stations, less of course for smaller ones. The figures look good—the words are sweet—the advice mysterious, the ads funny—maybe catchy, bright, and all that.

"My, those are clever ads," sighs the central station man. "I can see that $50,000 gross coming in and it will only cost me $5,000 to get it. Me for the $50,000."

Yes, there are cases of that kind—many of them. Did the advice expert stop to think what it was going to cost in the way of fuel—to use just one example—to make the extra current? Not he. Maybe the central station man did, but he was carried away with the glitter of words—the "catchy" sayings. They were "cute" and clever. "Cute" ads never won an extra dollar for a central station. The manager may think so, but let him dig deep and he will be surprised at the loss.

The average advertising expert knows nothing of the electric business. He knows he has accomplished certain things with other stations—he says he can with your plant.

Can he? He will answer and try to demonstrate he can. Very good. But don't take the advice the first moment. Let it rest in your desk for a week—two weeks are better. Things look very clever sometimes, at the first blush; they are silly a week later.

The advertising experts who are instructing the central station man to-day will feather their own nest—will make their business one of to-morrow rather than one of to-day—if they will stop, and weigh the situation.

Co-operation is a fine thing. But weigh matters—know—you can know. Go deep. Don't think all central station men are foolish. They are not. One advertising expert tried all kinds of advertising on the public. In the jumble the business increased. He confessed that it was luck.

"What I didn't know about the business was a crime," he said. "I had extra cute ads—I nearly laughed over some of my bright ideas and sayings—they were so funny. I should have been put in irons, but I learned. I studied. I know a bit different to-day."

That's all true; he should have been put in irons. But he had to learn—so do all central station managers. To-day some advertising managers are being "cute"; you don't have to be cute to get business. Rather give the central station man a bit more credit for having horse sense, and you, Mr. Central Station Man, don't be misled by bright ads. Weigh the campaign well; let the ideas and suggestions remain in your desk for a week. Ask questions; use the common sense that made you a manager.

## Interior Organization of Lighting Companies.

The subject of company organization was taken up recently in an address to the agents of the Edison Electric Illuminating Company, of Boston, by Mr. R. S. Hale, the general agent. He made an analogy between such a company and that which is perhaps the oldest organization in the world—an army. This theory of an army organization had virtually been carried out in the Boston Edison system, President Edgar, the commander-in-chief, having besides his own staff or executive bureau, four bureaus under him—construction, auditing, purchasing and operation. In each bureau there are departments, each with its departmental head, and in each department there are divisions with a divisional head, while in some divisions there are what might be called subdivisions. The point was that while there was delegated authority and responsibility everything in the final analysis went back to the one head, so that every single thing is done subject to the chief's approval, and theoretically every order either comes from him direct or is given because he has authorized it.

The keynote of this work is as follows: "Decide for yourself everything you are authorized to decide, and whatever you do keep your chief in touch with what you are doing. And further, when you do decide for yourself, don't consider yourself alone or your department alone, but try to make things work smoothly for everybody in the company."

With regard to the work of the agents, Mr. Hale stated that they had divided the territory into districts and assigned one or two agents to each district. The district agents are supposed to look after every customer and prospect in their district. Formerly they looked only after certain classes of business specifically, but now the local agent is supposed to find and get every bit of business that there is in his district. It was too much, however, to expect the same man to close a contract with a big dry goods house, lay out the lighting of a saloon, or plan an installation of motors in a factory. Hence, in addition to the district agents, they had specialists. Thus, for example, if the district agent sees the chance to get in a big sign he can start the ball rolling, but can call in the sign specialist for assistance. He need not be worried about the credit, for the report will take care of that. In some cases it is easier that the special agent should handle the business exclusively since one man should so far as possible be solely responsible for the dealing with the individual customer. In like manner the specialist, if he sees the chance to get in a good piece of work, should not let it go by. In other words, the whole of the work should be team work. "We want all the business and we must help each other to get it. Never mind if the credit goes elsewhere, you will get it in time and it will count all the more if your chief thinks of you as a man who is keen after getting business for the company and has no recollection of your taking up his time with claiming credit for work that has happened to get in under another agent's name." Mr. Hale closed by insisting upon the utmost courtesy and consideration being shown to a customer or a prospect.

## Lamp Hour Charges in Municipal Plants.

A study of electric lighting charges in municipal plants shows that the consumer is often obliged to pay a higher price per lamp-hour under the conditions of public ownership than a central station would charge in the same territory. An investigation recently made of the cost to the consumer per lamp-hour in several Massachusetts cities operating municipal plants brings to light some extremely interesting data, in comparison with the rates of the Edison Electric Illuminating Company, of Boston.

Tests upon representative lamps obtained from the different municipalities showed current consumption varying from 3.40 watts per candle-power to 3.66 watts in the 16-cp size. The standard 16-cp lamps supplied by the Boston Edison Company have a current consumption of 3.1 watts, so that the municipal plants examined all supplied lamps of from 9.7 per cent to 18 per cent larger energy consumption than the Edison lamps. In only two of the plants considered are lamps renewed free of charge to the consumer, the latter being obliged to pay from 20 to 25 cents in all the other installations for every new lamp put in service The tendency of this policy is naturally toward hesitation on the part of the consumer to replace lamps whose useful life has passed, the result being that the actual amount of light purchased costs too much in comparison with the central station rate on the free renewal basis.

The actual cost per lamp-hour should include the expense of renewals as well as the electricity charge. In figuring the cost the life of each 16-cp lamp was assumed to be 600 hours. The following comparisons then obtain:

| Municipality. | Net Rate per KW. Hour. | Renewal Price Per Lamp. | Cost per Current. | Lamp Hour Renewals. | Burned Total. |
|---|---|---|---|---|---|
| A | $0.15 | $0.20 | $0.838 | $0.033 | $0.871 |
| B | .20 | .20 | 1.117 | .040 | 1.157 |
| C | .13 | .25 | .730 | .045 | .775 |
| D | .12 | .20 | .670 | .033 | .703 |
| E | .12 | .20 | .689 | .033 | .802 |
| F | .15 | .20 | .898 | .033 | .931 |
| G | .18 | .25 | .994 | .045 | 1.039 |
| H | .15 | .20 | .852 | .033 | .885 |
| I | .135 | .20 | .767 | .033 | .800 |
| J | .15 | .25 | .872 | .045 | .917 |
| K | .15 | .20 | .877 | .033 | .910 |
| L | .20 | Free | 1.129 | ... | 1.129 |

The primary lamp non-contract maximum rate of the Edison Electric Illuminating Company, of Boston, is .9 cent. The secondary rate is .6 cent, making an average residence rate of about .8 cent. The company renews lamps free of charge. Stores burning lamps two hours per day or more can buy electricity on a contract basis giving a net rate of .7 cent per hour or less. The "economies of municipal ownership" do not seem to materialize extensively in the light of the above figures.

The investigation also included a series of recording voltmeter readings derived from commercial municipal circuits at points considered to be representative of average pressure conditions. In only two plants out of 16 examined was the regulation first class on the score of variations of short duration. The average variation in voltage from the mean throughout the day ranged from .2 volt to 3.8 volts. Extreme variations as high as 13 volts were noted in individual cases. Under such conditions the use of high-efficiency lamps is impracticable, which is only another way of saying that the actual cost of light is certain to be much larger with poor than with good regulation, as far as it bears upon the individual consumer. High voltage throughout the day is liable to be disastrous to the life of the lamps; low voltage during the early morning hours is not so objectionable, but during the maximum lighting load from 7 to 9 p.m. it means very unsatisfactory illumination. Lamps of 8 and 10 cp are more susceptible to the baneful influence of poor regulation and their delicate filaments are more easily broken, while for equal efficiency their life is shorter than the life of 16-cp lamps. These lamps should, therefore, be selected in comparatively low efficiencies if the regulation is inferior. The most satisfactory and economical lighting is not secured by forcing the lamps during the peak load. The influence of voltage variations upon the life

of 3.1-watt lamps may be cited in connection with the question of regulation:

| Percentage of Normal Volts. | Percentage of Useful Life. |
|---|---|
| 96.2 | 158 |
| 98.2 | 126 |
| 100 | 100 |
| 101.5 | 78.5 |
| 103.2 | 60 |
| 104.5 | 49 |
| 105.5 | 40 |
| 107 | 32 |

The enormous importance of steady voltage at the consumer's end of the line is apparent from these figures. There is certainly room for much improvement in the plants studied.

## Modern Methods of Advertising.

At the recent meeting of the Iowa Electrical Association, Mr. Frank B. Rae presented a paper with the above title, which is reprinted below:

A great deal has been heard within the past few months on this subject of advertising. The technical press has been full of it. Advertising agencies have bombarded you with it. In your personal meetings and conventions you have discussed and argued it. Advertising, in short, is the talk of the hour among electrical men—the fad. "Where will it all lead?" you ask.

It will lead to this: the business of manufacturing and marketing electric current will become as other businesses, and it will be advertised as other businesses. The trouble just now is that central station policy and practice is changing to meet new conditions. Heretofore, business has come to you. Hereafter, you must seek business. That is the meaning of all this furor.

Advertising, when stripped of its trappings and gilt, is a very plain, common-sense business proposition—a proposition of selling goods. While it would seem that this is simple enough, and obvious as the first proposition in geometry, it is a fact that only a very small percentage of so-called advertising conforms to this definition. On the contrary, the fundamental principle has been so hidden and befogged by a maze of high-sounding words, that not one man in a thousand of those who foot the bills knows what he is trying to accomplish, or is paying others to accomplish for him. He staggers along blindly, believing that any sort of announcement regarding his business is advertising, and the more startling the form and wording of this announcement, the better advertising he believes it to be. Just as idol worshippers of old clothed their religion in fearful mystery and expressed it in awe-inspiring pageantry and ritual, so the ad man of to-day shrouds simple truth in a garment of the inexplicable, and says much of nothing with pomp and ceremony.

There is just one mystery in advertising—the mystery of the personal equation. Advertising—real advertising—is good or bad, only as the man who prepares it is gifted or not gifted. Words are in every man's mouth, but every man cannot be a Patrick Henry. A pen is in every man's hand, yet every man is not a Shakespeare. The tools of advertising are within every man's grasp, yet very few men can write an effective advertisement. It is well for us to recognize at once that the gift to see and express in advertisements, the possibilities of a business is no more common than the gift to see and express in poetry the inspiring beauties of nature.

Advertising has been likened to salesmanship—salesmanship on paper is the expression of a clever ad man. For practical purposes this is a very good definition. Furthermore, it bears out what I have already said. You have all listened to the clever salesman. He came unknown, unasked, and unannounced. His dress and appearance were his credentials; a bright word his introduction. In terse, clean-cut English, he told his story; with convincing logic he drove home his argument; with undeniable assurance he solicited your business. Tact, courage, good breeding stamped each word. If he did not get an order, he left an indelible impression of the worth of his goods. Perhaps you did not want to buy them—for any one of a thousand reasons—but sooner or later his well-delivered arguments, his tactful insistance, will win you. You will buy.

What were this salesman's qualifications? He was tastefully, or at least decently, dressed; his introduction commanded your attention; his argument appealed to your reason; his tact and cleverness assured him a future opening if not an immediate sale. These are the qualifications of a successful salesman. They are the qualifications of the successful advertisement.

My paper was to be devoted to advertising method, yet I have spoken only of advertising matter. I have done this with purpose, for unless the matter is right no method will avail. Results of a sorry sort will come from almost any advertising, just as sales will be made from almost any salesman; but if you are to enter this field with an idea of profit, let me exhort you to pay the bulk of your attention to matter. The need of method will be self-evident.

It must be understood that the backbone of your business-getting department is the solicitor. Advertising can persuade a man of the advantages of your service; can convince him that he needs it; can crystallize his desire into an immediate demand for specific information touching his individual wants; but it cannot figure his installation, nor secure his signature to a contract.

Granted that you have intelligent and energetic solicitors, the advertising will be designed to bring the prospects to the point where it will require the least amount of the solicitor's time to close a contract. To do this is not the work of a single advertisement, nor of a number of diversified and disjointed advertisements. It is the work of a long-continued, regular, systematic advertising campaign.

It is here that the average lighting manager interposes objections. He is perfectly willing to take a "flyer"—to send out three or four mailing cards, perhaps, or insert a so-called "catchy" ad in the newspapers. Such advertising, if advertising it can be called, is the sheerest waste of money. Object as you will to this statement, if you but compare again your advertising campaign to the work of the accomplished salesman, you will begin to see the reason of the follow-up method; for your salesman does not always get an order on his first call, nor his second, nor the third. It may take a half dozen calls to educate a prospective customer to the advantages of his goods, and to win his confidence—in short, to bring him to the buying point. Had the firm employing this salesman sent a different man each time; had the various men employed radically different methods, it is probable that little, if any, attention, would have been paid to their solicitations. But the one man, the one method, the constant, aggressive, persistent follow-up, is what lands the order. And that is what will land orders from advertising.

The matter of such a follow-up campaign should be planned, prepared and systematized in advance with very strict regard to local conditions. It is in the planning and systematizing that such a campaign wins or loses—in the logical sequence of the advertising used. The system of handling inquiries, of checking and revising the mailing lists, of adapting the solicitors' labor and reports to the mutual benefit of both solicitors and the advertising—these are all vitally important points to be settled before a single piece of matter is issued. Having settled them the actual follow-up work resolves itself into the very simple proposition of seeing that the matter goes out promptly on the scheduled dates, that inquiries are carefully followed, and that the enthusiasm of the soliciting force is kept at fever heat. When it is understood that the chief object of the advertising is to pave the way, introduce and make definite appointments for the solicitors, the importance of having the latter always aggressive will be appreciated. The actual business-getting must, and always will, remain with the soliciting force.

"Modern Methods of Advertising," so far as the central station is concerned, means merely that you regularly and persistently keep the advantages of your service before every prospective customer within reach of your mains. That such methods can be profitably adopted by the smaller plants has been demonstrated.

But a warning should be sounded. Do not make your advertising too elaborate, or too voluminous, nor waste it upon ill-chosen lists. Above all, do not allow it to be designed by an advertising man ignorant of the ethics of the lighting business, or by a lighting man lacking in advertising genius and experience.

# Shall Central Stations Sell Apparatus?

By T. M. MESTON.

In view of the agitation now being made by various advertising companies and co-operative associations with a view to having central stations and manufacturers undertake extensive general publicity advertising plans so as to educate the public to the greater use of electrical apparatus, would it not be well to spend some time in analyzing the present trade conditions? Before spending large sums of money and a great deal of time and energy in endeavoring to build up business from the user, it would seem that the common sense thing to do would be to first put the business that is already developed on a business-like and profitable basis.

Commercial conditions in the electrical trade are extremely unsatisfactory, the dealer and contractor cannot make enough profit to eke out a bare existence; the jobber is not making enough money to pay expenses and the unsatisfactory profit made by these two classes of dealers re-acts on the manufacturer in a continual pressure for lower prices, which results either in an unhealthily low margin of profit to the manufacturer, or a reduction in quality.

The present unsatisfactory conditions are undoubtedly due to the fact that the electrical business as a whole is new. It has not been in existence long enough for the proper trade lines to become established and for the proper principles of trading to be understood and applied by the manufacturers, jobbers, retailers and central stations.

Even brief consideration of this subject will show any impartial investigator that almost every primary principle of correct merchandising is violated by all classes of electrical trade. These conditions have grown up naturally enough and while present practices were unavoidable in the infancy of the business, they are harmful in the present stage of development and unless corrected will work to the harm of every electrical interest.

At the present time manufacturers and jobbers are selling a greater or less proportion of their product direct to the consumer. It is no unusual thing to find manufacturers, jobbers and contractors all trying to sell to the same consumer. The jobber and manufacturer commonly quotes almost as low, and sometimes fully as low prices direct to the user as he quotes to the dealer or the jobber. Under these conditions how can a permanent and successful business be built up?

While it is necessary to sell certain kinds of apparatus and to certain large consumers direct from the factory, there is no reason for either the manufacturer or the jobber selling to the average user at any price, such material and apparatus as the retailer can handle to advantage. In all other lines of business the big outlet to the general public is through the retailers and the principles of distribution are no different in the electrical field than in any other line of merchandising. No electrical man would expect to go to a large collar manufacturer or dry goods jobber and be able to buy half a dozen collars at any price. He would be absolutely astonished if he found that he could buy these collars only at a price 10 or 20 per cent higher than the retailer paid for them, yet in every city in this country any private citizen can go to a jobber in electrical apparatus and buy anything he wants. There may be some exceptions, but the above is certainly the rule. Not only this, but many of the largest electrical manufacturers have retail prices and will sell even small supplies at retail. There is no doubt but that the wants of the general public should be supplied through the local retail dealer and the prices to the public should be sufficiently high so that the retail dealer can make a net profit above his expenses. On an average the cost of conducting a retail business will be at least 25 per cent of the sales and a retailer cannot exist unless there is an average margin of from 33⅓ to 50 per cent between the wholesale price named by the manufacturer or the jobber and the retail price.

The writer was for many years connected with the largest hardware jobbing house in the world and based upon his experience in that line will make bold to suggest a remedy for the present deplorable condition of the electrical trade. The manufacturers and jobbers should not sell at retail at any price, the class of supplies and apparatus that can be handled to advantage by the local retailer. This should cover all the small items such as are in daily use and such as can be handled by the retailer. The retailer is not in a position to handle large apparatus, neither is he in a position to sell to central stations, railways, telephone exchanges, who while strictly speaking are consumers, are still such large buyers of electrical merchandise that they properly should buy at wholesale and at wholesale prices from the manufacturer or jobber direct. The central stations if they sell merchandise should consider themselves retailers and should charge a retail profit.

A very pernicious doctrine has become current in electrical circles to the effect that the central station is interested in selling electricity and that it can afford to sell apparatus and supplies, and do construction work at cost or at a loss as the profit in the electricity evens matters. A moment's reflection will show the absurdity of this reasoning. If a central station is a retailer of merchandise as well as a producer of electricity, it is really in two separate businesses—it cannot expect to retail merchandise any more economically or with any less expense than any similar retailer handling the same volume. If the merchandising part of the business is carried on at a loss, the loss must be made good from the net profits of the manufacturing department and the proper thing to do will be to separate these two departments entirely, sell the electricity at what it is worth, make the profit on it and also sell the merchandise at the proper price and have each department bear its own burden. If the price for electricity is so high that there is a satisfactory profit after-making up a large deficit on the merchandising department, the company should either reduce its rates, or it should retain the extra profit for the benefit of its stockholders. Aside from any arguments as to the proper accounting system to be employed the central station actually does itself injury by selling apparatus and supplies at unhealthily low prices to the general public. The most serious effect is to procure either the active or the passive opposition of every contractor and dealer that hopes to make a living from the electrical business.

In every large city there are a number of electrical dealers and contractors and there is no question but that if the central stations would either abstain from merchandising, or better still, handle merchandise, but handle it at a proper retail price, they would procure the active co-operation of the local electrical dealers and contractors. There is much to be said in favor of the central station handling apparatus, as at the present time the dealers and contractors have not sufficient capital to carry the stock. If the central station carried the stock of apparatus and did the purchasing, selling to the general public at an adequate retail price, the dealers could also sell at these prices and would gradually build up their business so that electrical dealers would be as prosperous and financially responsible as retail dealers in other lines. As this desirable result is gradually attained, the dealers would carry larger stocks and possibly would ultimately relieve the central station from the necessity of merchandising, allowing the central station management to confine itself entirely to its proper sphere of producing and selling electricity.

Another trouble with low retail prices named by central stations is the fact that very often the prospective purchaser is really afraid to buy at the low prices; numberless instances have come under the writer's notice where consumers have actually been afraid to purchase, feeling that a reliable and satisfactory piece of apparatus could not be furnished for the low price asked. The general public are so thoroughly imbued with the idea that there is a large difference between the wholesale and retail price that they are unable to realize that electrical people are so foolish as to sell at retail at prices little, if any, higher than the wholesale price.

When a consumer is told by his retail electrical dealer that the central station is selling apparatus and supplies at cost because the central station can afford to do this by reason of their making a profit on the energy consumed, the consumer is very likely to reason that there is an exorbitant profit in the energy sold and this is certain to react against the central stations by

gradually building up a public opinion that the rates are too high with consequent agitation and possible legislation controlling and reducing the prices of electrical energy.

If space permitted, there are other minor abuses that might be mentioned, such as the same firm being at one time a manufacturer, jobber and contractor, thus competing directly with its own customers in every branch, but space will only permit mentioning the most important points.

As the largest interests are properly the ones to first study the situation and provide a definite remedy, let us hope that such large concerns as the General Electric Company, Western Electric Company and Westinghouse Company, working if possible in harmony with the jobbers, will in the near future take some definite action toward stopping the retailing of electrical merchandise at wholesale prices. The manufacturing interests mentioned above, together with the jobbers in the various cities are supposed to combine the best intelligence and judgment to be found in the electrical trade, and there is no doubt that these interests could make some division in their line of manufacture and in the class of trade which would enable the retail dealer and central station to understand exactly what classes of trade and what kinds of merchandise these large interests would sell at wholesale prices to the user, and on which side of the line the retailer would understand that the retail prices were left to be adjusted by the retailers in accordance with local conditions.

In order to avoid a possible misunderstanding, it is necessary to say forcibly that nothing in this letter is intended to convey the idea that the manufacturers and jobbers should form combinations to control or fix prices either at retail or between different classes of trade. If the manufacturers and jobbers will decide either individually or collectively that certain classes of goods will not be sold by them to the average user, the way is open for the retail dealer and central station to take the position that retail prices will be charged that are fair to the user and still provide a living margin of net profit to the retailer. This is not a matter to be arranged by associations or combinations, it is only necessary for each dealer, be he large or small, to take the common sense stand that, so far as he is concerned, he will procure a price that will leave him some margin of profit. If each individual will take this position, the benefit to the entire electrical trade would be very noticeable.

## Electric Lighting in Theatres.

At the May meeting in Chicago of the National Fire Protection Association, a report will be presented by the committee on theatre construction and equipment. Advance copies have been sent out by the Underwriters' Laboratories of Chicago. The sections relating to the proposed provisions for lighting are as follows:—

Every portion of the building devoted to the uses or accommodation of the public, also all outlets leading to the streets, and including the open courts and corridors, shall be well and properly lighted during every performance and the same shall remain lighted until the entire andience has left the premises.

There shall be one light within a red globe or lantern, placed over each exit opening, on the auditorium side of the wall.

Gas mains and electric light wires supplying the building shall have three independent connections as follows: One for the stage, one for the auditorium, excepting the exit lights therein, and the third for the halls, corridors, lobbies, exit lights, including the exit lights in the auditorium, and such other portions of the building used by the audience outside of the auditorium proper.

All gas and electric lights in the halls, corridors, lobbies and other portions of the building used by the audience, with the exception of the auditorium proper, but including the exit lights therein, shall be controlled by two separate switches or valves, one to be located in the lobby and the other to be so located as to be operated from the outside of the building.

Provision shall be made for shutting off all gas at a point outside of the building.

Interior gaslights must be lighted by electricity or other suitable appliances, to be approved by the underwriters having jurisdiction.

All suspended or bracket lights surrounded by glass, in the auditorium, or in any part of the building devoted to the public, shall be provided with proper wire-netting underneath.

No gas or electric light shall be recessed in the walls, woodwork, ceilings, or in any part of the building unless protected by fireproof materials.

All lights in passages and corridors in said buildings, and wherever else deemed necessary, shall be guarded with proper wire network.

The footlights must be electric, and in addition to the wire network, shall be guarded with a strong wire guard and chain drawn taut, placed not less than 2 ft. distant from said footlights, and the trough containing said footlights shall be formed of and surrounded by fireproof materials.

All border lights shall be electric, constructed according to the requirements of the National Electrical Code.

All ducts or shafts used for conducting heated air from the main chandelier, or from any other light or lights, shall be constructed of metal and made double, with an air space between, or some other approved fireproof material may be used.

All stage lights shall be electric, installed in accordance with the requirements of the National Electrical Code.

The bridge calcium lights at sides of proscenium shall be enclosed in front and on the side by galvanized iron, so that no drop can come in contact with the lights. Electric calciums, so-called, are included in the above requirement.

# Letter to the Editors.

## Good Taste in Central Station Advertising.

*To the Editors of Electrical World:*

Sirs:—I wish to express hearty agreement with the position taken by Mr. F. L. Rae in his article entitled "Good Breeding in Advertising," printed in your issue of April 7. It is doubtful if coarse and slangy advertisement writing appeals even to the lower social strata of Americans, and it certainly is woefully inappropriate when addressed to the select audience to which, under present conditions, the central station must confine its appeals. However little cultured a class may be which one desires to interest through an advertisement, it should not be lost sight of that the reading of books has fixed in their minds a literary standard which, though perhaps always lost sight of in conversation, yet recurs in reading the printed word. If in order to reach the masses it were actually necessary to descend to a degenerate English, it would appear equally necessary for the Stevensons and Kiplings, the Henry Georges and Jack Londons, to work in collaboration with a master of vernacular and slang who would, for pouular editions, translate their sentences into the language of the "masses."

But that to violate all the canons of taste and to murder the Queen's English, is not a necessity in advertisement writing appears to be absolutely demonstrated by the success of those advertisers whose announcements are always in excellent taste. We need only to offer as examples the advertisements of Pear's Soap and Ivory Soap—which cannot be held to appeal only to the cultured—and to the daily announcements of the Wanamaker stores. The cause of the lapses to which this letter refers—leaving aside inherent low taste, which undoubtedly in some cases is a large factor—appears to be that the fundamental principles of advertising writing are too narrowly or entirely wrongly construed. As Mr. Rae states, an advertisement should be so written as to attract attention, but by many this principle is applied in the most primitive fashion, poverty of thought leading to the adoption of slang expressions or glaring impertinences. Then again, too often the principle of conciseness is thought to be met by the clipping of a letter from a word or the elision of particles from a sentence, while style is taken to mean merely oddity of expression.

That there is an art of advertising writing and a difficult one, cannot be disputed; but it is too frequently practiced as a house painter who exchanged his paint pot for a pallette, would practice the art of Raphael. Slangy expressions are no more apt to be factors of success in advertising than in other lines.

BOSTON, MASS. S. L. POWERS.

# DIGEST OF CURRENT ELECTRICAL LITERATURE

## Dynamos, Motors and Transformers.

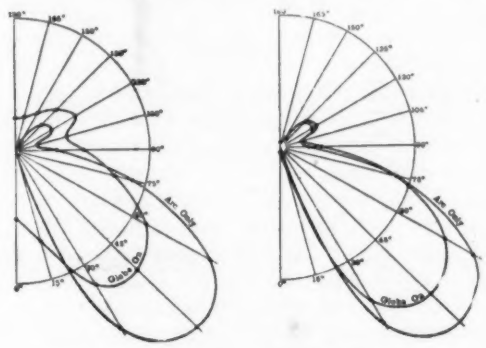
*Flux Distribution in Machines with Commutation Poles.*—WALL AND SMITH.—An account of tests of a bipolar machine provided with two commutation poles (interpoles) and designed for 110 volts at 42 amp. The distribution of flux due to a single commutating pole and that due to both commutating poles together are discussed. If the arrangement of the machine is symmetrical and if the commutation poles alone are excited the flux will simply pass through the armature yoke, none of it going through the main poles. In exactly the same way, if the main poles are excited and the commutating poles unexcited, no flux whatever will go through the latter. Hence if both sets of poles are simultaneously excited, the result is a superposition of the two fields; that is, each field acts as if the other was absent, the two fields being independent of each other. These results were fully confirmed in the experiments of the author. (In an editorial note in the same issue it is pointed out that the experiments were made with the armature at rest, and that the authors say nothing about the distribution when the armature is loaded and running. If we consider the armature ampere-turns in the direction of the brushes they will be found to correspond to back turns with regard to the turns on the auxiliary poles. It appears likely, however, that the flux distribution in the machine on load is not different in principle from that at rest. If this view is correct, the use of a separate magnetic circuit for the auxiliary flux should be unnecessary. However, in actual machines with commutation poles a separate auxiliary magnetic circuit is used so that perhaps there are some other considerations to be taken into account, such as the possibility of laminating the entire auxiliary system to accelerate the response to sudden changes of load.)—Lond. *Elec.*, April 6.

## Lamps and Lighting.

*Lamp Globes.*—PRENTICE AND WESTERDALE.—A paper read before the Students' Section of the British Inst. Elec. Eng. on the determination of the polar curves of light distribution from arc lamps surrounded by globes. Four different kinds of globes were used and both the mean spherical and mean hemispherical candle-power were determined. The results are as follows:

| Globe. | Mean spherical cp | | | Mean hemispherical cp | | |
|---|---|---|---|---|---|---|
| | Arc only | Arc in globe | Mean spherical ratio per cent | Arc only | Arc in globe | Mean hemispherical ratio per cent |
| 13-in. alabaster .... | 346 | 339 | 98.0 | 592 | 473 | 79.9 |
| 13-in. clear ..... | 346 | 308 | 89.0 | 592 | 520 | 87.9 |
| 13-in. opalescent ... | 342 | 343 | 100.0 | 288 | 238 | 82.8 |
| 12-in. prism ..... | 342 | 306 | 89.5 | 288 | 250 | 86.9 |

The photometric curves for an alabaster globe and for a clear glass globe are given in Figs. 1 and 2. In a general way the photometric curves for the opal globe are similar to those for the alabaster globe, while those for the prism globe are similar to those for the clear glass globe. In the case of the alabaster and opalescent globes the globe itself becomes to a certain extent the source of light, owing to dispersion, so that when the globe is used there is a measurable candle-power even up to 180°. The opalescent and alabaster globes cut off a large percentage of the light; this is not all lost, however, part being dispersed and a part reflected back to increase the candle-power in the directions where, for the arc alone, it would be either nothing or very small. For street lighting all light above the horizontal is useless, so that globes that disperse the light well through the 180° are unsuitable, although the mean spherical ratio may be great. The mean hemispherical ratio is the more important in this connection. The clear glass and prism globes have the highest mean hemispherical ratios, so that for street lighting these globes would be more suitable.—Lond. *Elec.*, April 6.




FIGS. 1 AND 2.—PHOTOMETRIC CURVES.

*Arc Lamp Lowering Gear.*—An illustrated description of a new suspension for arc lamps, which breaks contact when the lamp is lowered. It is shown in Fig. 3. Current is conveyed by the cables to the two hinged pieces, $C_1$ and $C_2$, which act at the same time as contacts and suspending hooks for the lamp. These suspenders are insulated with mica and have their hooked ends tipped with phosphor-bronze springs, which form the contacts. Each is provided with a releasing shutter, *R*, which when pushed up enables the hook to engage in the annular socket on the under side of the lamp insulator, but when down closes the hook so that the descending insulator passes by and pushes the suspender arm aside. The suspenders in the figure are shown in these two positions, but they will, of course, in reality both be always in the same position. Thus when the lamp is going into engagement the releasing shutters rise up and allow the suspenders to engage when the lamp is lowered after touching the stop. For disengaging, the lamp is raised high enough to free the shutters and cause them to fall, and prevent the hooks engaging. Thus the whole action depends on raising the lamp higher for disengaging than for engaging. This is done automatically by a stop, *S*, which contains a triangular piece, which is partly rotated by the act of lowering, so that it projects and prevents the stop passing into a slot when the lamp is next raised for engagement. The lamp spindle has a self-centering and self-locating device, consisting of a stud and a slot, which insures the right contact being made. The lamp contacts are well pro-

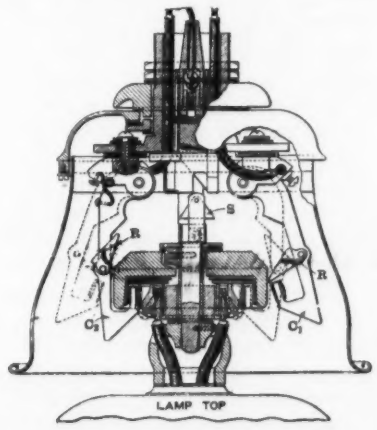



FIG. 3.—ARC LAMP SUSPENSION.

tected, as they are on the underside of the insulator.—Lond. *Elec.*, April 6.

*Economical Life of Incandescent Lamps.*—Wild.—When the average life curve of incandescent lamps is known and the price of the energy and of the lamps is also given, the point in the life of lamps can be calculated at which they should be renewed in order to get maximum economy. The author has made tests of a number of ordinary commercial 200-volt, 16-cp lamps and taking the cost of the lamp at 20 cents, he finds that the correct scraping point is 1,000 hours if the price per kw-hour is 2 cents, 650 hours for 4 cents, 500 hours for 6 cents, 450 hours for 8 cents, 400 hours for 10 cents and 350 hours for 12 cents.—Lond. *Elec. Rev.*, April 6.

## Power.

*Gas Producer Plant for Electric Stations.*—Sowter.—A paper read before the Dublin Section of the British Inst. Elec. Eng. After some general remarks on gas producers, the author states that the first British apparatus for the conversion of bituminous small coal into combustible gas, and for the recovery of sulphide of ammonia, was put into operation at Brunner, Mond & Co.'s works at Northwich. Sulphate of ammonia is a valuable by-product. It is claimed that one ton of ordinary slack will yield from 140,000 cu. ft. to 160,000 cu. ft. of gas, and also furnish the ammonia equivalent to 90 lb. of sulphate of ammonia when manufactured upon a sufficiently large scale. In small plants, however, the quantity of sulphate of ammonia recovered is too small to warrant the capital outlay upon the necessary plant, and it is recommended that this part of the plant is better omitted when the quantity of fuel to be gasified daily amounts to less than 30 tons; moreover, in order to secure the most efficient and satisfactory results it is desirable that the process should be continuous during the whole 24 hours. After some remarks on other types, the author refers to suction gas producers which are shown to offer very many advantages in the case of quite small installations. He discusses some troubles with gas engines and remedies therefor. The type of engine most suitable for central station work is, in the author's opinion, the vertical, with three or four cylinders, the dynamo or alternator being direct-coupled to the shaft. Such a plant takes up little space, as compared with a horizontal engine, and compares generally very favorably with a steam plant. With this type of plant great cyclic regularity is obtained, and an immunity from vibration. The exhaust from an engine with several cylinders, and governed by throttling a constant mixture, is much more silent than that of a single-cylinder engine governing on the hit-and-miss principle. Finally some figures are given on the economy of gas plants, especially on the results obtained at the Walthamstow plant. The capacity of this plant now installed is close upon 3,000 hp, and it is by far the largest gas-driven station in the British Isles. The plant consists of 13 Westinghouse gas engines direct-coupled to continuous-current generators. The first installation consisted of four 115-hp engines; the first extension, three 250-hp sets, while recently six more 250-hp sets have been added, three of the latter being in daily use, supplying energy to the tramway system. The following are particulars of the cost of energy per kw-hour sold during the last year:

The number of kw-hours sold was 1,062,446; the load factor, 15.45 per cent.

| | Cents | |
|---|---|---|
| Coals and other fuel | .84 | |
| Oil, water and engine stores | .20 | |
| Wages | .66 | |
| Repairs | .18 | |
| Works cost | | 1.88 |
| Rent, rates and taxes | .04 | |
| Management | .44 | |
| | | .48 |
| Total cost | | 2.36 |

"No doubt, had the bituminous type of gas plant been further developed at the time the Walthamstow station was started, such a plant would have been installed in preference to the present anthracite plant, and this would probably have had the effect of reducing the coal bill to something like 0.4 cents per unit."—Lond. *Elec.*, April 6.

*Portable Electric Drills.*—Stewart.—A paper read before the Glasgow Technical College Scientific Society on the design and industrial application of portable electric drills. With a view to keeping down the rise of temperature, and therefore the linear dimensions, the fixed losses in an electric motor, subject to a variable load, should be relatively small in relation to the variable losses, because the average losses fix the temperature and these will be less the lower the fixed losses become. The author then speaks briefly on geared and gearless tools and discusses at greater length forced ventilation. With large portable tools gearing is necessary. A large ratio of reduction can, in most cases, be justified on the score of efficiency and light weight, as the weight of an increased gearing is not as great as the increase in the weight of a slower speed motor. The following figures show the speed, weight and efficiency of a standard motor, a light-weight automobile motor and a special electric drill motor.

| | Intermittent rating "standard." | Intermittent rating "special." | Electric automobile motor. | Electric drill. |
|---|---|---|---|---|
| Hp | 1¾ | 1¾ | 1¾ | 1¾ |
| Speed | 1,700 | 2,700 | 2,000 | 4,800 |
| Efficiency | .70 | .69 | .69 | .71 |
| Weight | 156 lb. | 132 lb. | 90 lb. | 58 lb.* |

*Including gear reducing to 100 revs.

As a matter of fact the machine marked "special" is on the verge of impracticability, as the variable losses, i. e., losses which increase as the square of the current, have become so great that the machine has passed the limit at which it can be kept cool without difficulty on loads where the periods of rest equal the periods of work, neither exceeding a few minutes, which is the usual interpretation of the term "intermittent rating," such as is usual for cranes, hoists, etc. Pillars for drilling are usually fixed by bolts and nuts in the desired position, but the author recommends the use of a magnet in the base of the pillar as a substitute for the bolts and nuts. He then speaks at some length on the efficiency of electric drills. Fig. 4 gives data on the power

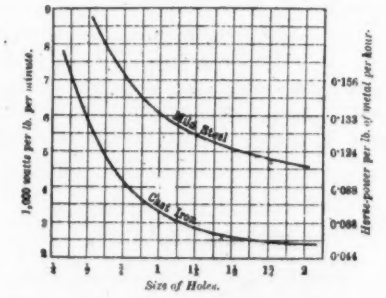



FIG. 4.—POWER CURVES.

required for drilling mild steel and cast iron, the figures being the horse-power per pound of metal removed per hour for drilling holes of different sizes. By separating the machine losses and determining how much is left for work at the drill point the

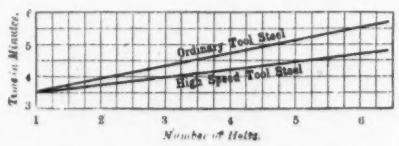



FIG. 5.—HORSE-POWER CURVES.

author found the latter power to vary from 0.07 to 0.1 hp per pound of metal per hour for mild steel, and 0.035 to 0.06 hp for cast iron; the first figure referring to holes of the order of two

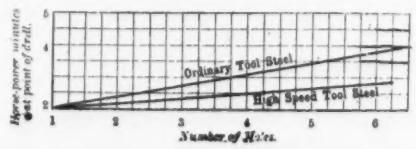



FIG. 6.—HORSE-POWER CURVES.

inches and the latter to small holes. Figs. 5 and 6 show the relative merits of ordinary and high-speed tool steel. The results were obtained during some tests when several holes were drilled in succession, the work done being measured by weighing the block after each hole and observing the time per hole, and also

power used. It will be seen from Fig. 5 that there is an increase of 36 per cent in the time taken to drill the sixth hole when compared with the first with high-speed tool steel, and 58 per cent with ordinary tool steel, the power being maintained exactly the same in each case—the difference in favor of the high-speed tool steel being 14 per cent. Fig. 6 shows the striking difference when not only time but the power is taken into consideration. In this case the ordinates are horse-power minutes at the point of the drill, and show how great are the advantages of high-speed tool steel, necessitating, as will be seen, 38 per cent increase at the sixth hole, as against 90 per cent in the case of ordinary steel.—Lond. *Elec.*, March 30.

*Steam Engines Versus Steam Turbines and Gas Engines.*—SCHOEMBURG.—An article giving an estimate of costs of equipping a mill with an electric power plant for supplying direct current to lamps and motors, the power needed during the day being 900 kw and during the night 250 kw. The following three systems are compared: Dynamos driven by steam engines; dynamos driven by steam turbines, and dynamos driven by suction gas engines. The estimate of cost depends, of course, on local conditions and on various assumptions which are made. The results are as follows, the figures giving the first cost per kilowatt and the cost of operation per kw-hour, respectively:

| | First cost per kw. | Cost of operation per kw-hour. |
|---|---|---|
| Steam engines ..... | $135.00 | 1.44 cents. |
| Steam turbines ..... | 104.50 | 1.30 " |
| Gas engines ..... | 112.75 | 1.15 " |

The general conclusion is that the question which system is the best must be solved for each case and cannot be answered in a general way.—*Elek. Zeit.*, March 29.

### Installations, Systems and Appliances.

*Storage Batteries in Three-Phase Systems.*—SCHROEDER.—A paper read before the Berlin Elec. Society. The simplest way to use a storage battery in connection with a three-phase system would be through the intermediary of a motor-generator consisting of a direct-current machine and a three-phase machine.

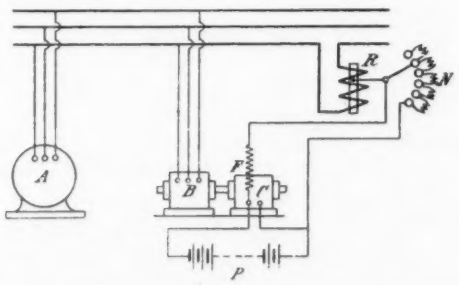



FIG. 7.—DIAGRAM OF CONNECTIONS.

With this arrangement, however, the storage battery begins to discharge into the three-phase system or to be charged from it only when the speed of the motor-generator decreases or increases. A much closer regulation may be obtained by an ar-

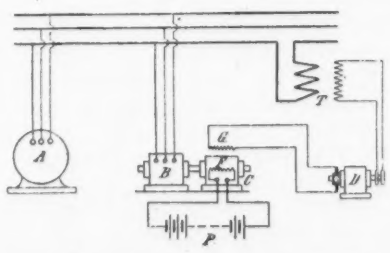



FIG. 8.—DIAGRAM OF CONNECTIONS.

rangement indicated in a general way in Fig. 7, where a relay, *R*, is provided, acting automatically on the shunt regulator, *N*, which determines the field, *F*, of the direct-current machine, *C*, of the motor-generator, *B C*, *B* being the alternating-current machine of the same set. *A* represents the three-phase generating plant. An application of this method made by the Allg. Elek. Ges. in connection with an electric winding plant at a mine is described. The relay used in this case is that of Tirrill, which is described in detail, as is also that of Entz, which is well-known in this country. The author then discusses several arrangements in which no relay is used. One of the methods is shown in Fig. 8. One of the conductors of the three-phase system contains the primary of the transformer, *T*, which feeds the converter, *D*. The direct current given out by *D* is directly proportional to the three-phase currents and is supplied to the exciting windings, *G*, of the direct-current machine of the motor-generator, *B C*. These exciting windings, *G*, are wound in a direction opposite to that of the shunt exciting winding, *F*. When the three-phase currents increase, the voltage of *C* is diminished so that the storage battery discharges into *C*. On the other hand, when the three-phase currents decrease, the voltage of *C* increases and the storage battery is charged. The converter, *D*, is placed on the

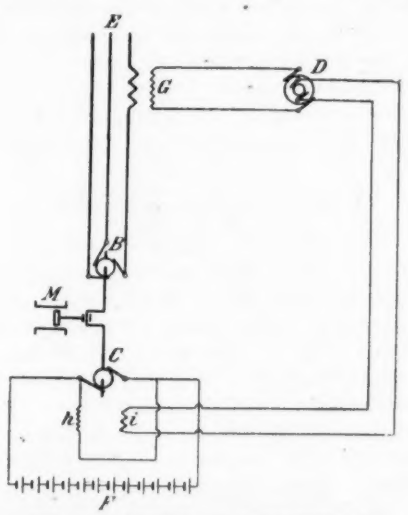



FIG. 9.—DIAGRAM OF CONNECTIONS.

same axle as the motor-generator, *B C*. It is stated that the Siemens-Schuckert Company uses this method in a recent installation which has proven satisfactory and that interpoles are advantageously used for the machine *C*. A modification is shown in Fig. 9 where the converter *D*, acts on a booster, *C*. In this case it is also preferable to place the motor-generator, *B C*, the converter, *D*, and the booster, *K*, on the same axle. A converter may be used here instead of the motor-generator. Other modifications are also described and illustrated and applications to the hauling problem in mines are especially dealt with.—*Elek. Zeit.*, March 29.

*Storage Batteries.*—SALTER.—A paper read before the Manchester Section of the British Inst. Elec. Eng., giving "economic considerations in the employment of storage batteries." The author emphasizes that a storage battery cannot be considered as an addition to the generating plant. If one wanted to use it in case of a breakdown in the generating plant, the battery capacity would have to be enormous. The only real advantage which the author acknowledges in favor of the storage battery, is that it gives some improvement in the load factor, "due to the fact that with batteries the generating plant in a given time has not only to supply the useful units in a system, but has also to supply the units which are lost in the battery; and as the total annual steam consumption is made up of two terms, the first dependent upon the number of hours the set is run, and the second dependent only upon the number of units generated, the cost of fuel per unit generated is bound to be less, owing to the greater number of units generated, and which are lost in the battery; but the cost per unit usefully supplied will not be so largely affected." The author states that a reduction in the cost of generation with a 33 per cent improvement in the load factor is only 8 per cent and that as the load factors are increased, the improvement due to the introduction of batteries reckoned as a percentage decreases to a point which becomes almost insignificant. Upon general grounds, therefore, the author is led to the

conclusion that in moderate-sized stations the advantages to be obtained from the use of batteries are not justified by the capital charges involved. Two examples are given from actual plants in which the batteries do not prove valuable. In the discussion it was pointed out, however, that these two cases can hardly be recorded as typical.—Lond. *Elec.*, April 6.

*Manchester.*—A continuation of an illustrated article on recent extensions at the Manchester electricity works. The last additions to the generating plant at one station are two 750-kw direct-current turbo-units. The dynamos are four-pole machines with interpoles, and have a series winding in addition to the shunt winding, so that they may be used for lighting or traction. As shunt machines they supply 1,870 to 1,670 amp. at 400 to 450 volts, and as compound machines up to 1,360 amp. at 500 to 550 volts. The speed is 1,600 r.p.m. The interpoles in these machines belong to an entirely distinct magnetic system, comprising a separate yoke and four poles. This yoke is made up in two rings, rather less in diameter than the main yoke, and the poles, which have the same length, measured along the axis of the machine, as the main poles, and are laminated, project into the space between the main poles. The five-wire network (at 5 × 100 volts) has been retained in the central part of the area, but all the outer area is on the 2 × 200 volts, three-wire system.—Lond. *Elec.*, April 6.

### Electrophysics and Magnetism.

*The Positive Column.*—Villard.—A paper in which the author discusses the deflection of the positive light in a vacuum tube, with a view to elucidating its mechanism. In the classical experiment concerning its deflection by a magnet, it is found that the beam is bent out towards the region between the poles of the electromagnet somewhat like an elastic band. It behaves like a filament carrying a current. In this phenomenon the walls play a prominent part unless the tube is very wide. In a wide tube the positive particles no longer behave like a conducting filament. Their paths twine round the lines of force of the magnet field in such a manner that they diminish the field. A conducting filament, on the other hand, rolls itself up in such a manner as to increase the magnetic field. When the field is increased the spirals described by a projected particle diminish in diameter, whereas those of a conducting filament increase. If the positive column consists of particles at rest, or in very slow motion, it may be regarded as a conducting filament. Its positive charge is evidenced by its attraction by a negative pole, and its repulsion by the walls. Its length is increased by increasing the current strength or narrowing the tube.—Lond. *Elec.*, April 6; from *Comptes Rendus*, March 19.

*Radioactivity of Thorium.*—Dadourian.—A Phys. Society paper giving the results of experiments which show that the radioactivity of thorium, and consequently the radiothorium in a mineral, is proportional to the quantity of thorium present in the mineral; further, that radiothorium is a disintegration product of thorium. The fact that commercially prepared thorium salts have lower specific thorium activity leads to the conclusion that about half of the equilibrium quantity of radiothorium is removed from these salts in the chemical process of their preparation. The results of the experiments strongly indicate the elementary character of thorium itself.—*Phys. Rev.*, April.

*Polarization of Secondary Röntgen Rays.*—Barkla.—An account of experiments in which the author succeeded in proving the polarization of secondary Röntgen rays by choosing carbon as a secondary and tertiary radiator.—Lond. *Elec.*, March 30; from *Proc. Royal Soc.*, 516, March 6.

### Electrochemistry and Batteries.

*Nitrogen from Air.*—Guye.—A paper discussing the principles of the fixation of atmospheric nitrogen either in the form of calcium cyanamide by an electric furnace process or in the form of nitric acid by spark discharges through air. The latter case is discussed strictly on the principles of modern physical chemistry, whereby the author makes the fundamental supposition that there is no specific electric effect of the discharges, but that the reaction is simply determined by the temperature and the pressure. It is necessary to produce a high temperature in order to combine the nitrogen with the oxygen; this is done by the electric arc discharge. The second requirement is to cool the produced gas mixture quickly to a low temperature as otherwise a great portion of the obtained products would undergo the opposite reaction. It is finally suggested to use liquid air for the production of nitrogen and oxygen; the nitrogen gas to be used in cyanamide manufacture and the oxygen in the combustion of atmospheric air by arc discharges. Both industries should, therefore, work in harmony. The same issue contains an article giving recent commercial developments with the Birkeland-Eyde process in Norway, producing calcium nitrate which is called Norwegian saltpetre. It is reported that a large German chemical company will erect a water power plant for the production of nitric acid by the same process to make potassium nitrate for explosive purposes. An editorial in the same issue gives a concise review of all the different possibilities which have been suggested for fixing atmospheric nitrogen.—*Electrochem. and Met. Ind.*, April.

*Containers for Accumulators.*—Schoop and Liagre.—The conclusion of the illustrated article on various methods of constructing containers for alkaline and lead accumulators. In the present installment containers of sheet iron or steel are dealt with and the following methods are covered: folding, electric welding or welding with the oxyhydrogen flame, spinning, pressing with extremely high pressures (method of Huber), electrolytic deposition.—*Electrochem. and Met. Ind.*, April.

### Units, Measurements and Instruments.

*Measuring Voltages with the Aid of Nernst Lamp Ballasts.*—Kallmann.—The iron wire resisters which are used as "ballast" in connection with Nernst lamps in order to keep the voltage at the filament terminals constant may be used in connection with other resisters for comparing and measuring voltages. The simplest arrangement is shown in Fig. 10, where $r_1$, $r_2$ . . . $r_{10}$ are

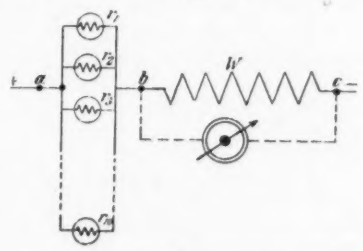


FIG. 10.—MEASURING VOLTAGES.

the iron wire resisters (which are called by the author "variation resisters"). They are designed for 0.15 amp. and 10 to 30 volts. When the voltage between $a$ and $c$ varies between 210 and 230 volts, the voltage between $b$ and $c$ is practically constant = 200; since any voltage between 10 and 30 volts is consumed in the variation resisters, $r$. A voltmeter connected to $b$ and $c$ can, therefore, be calibrated, since the arrangement gives a constant

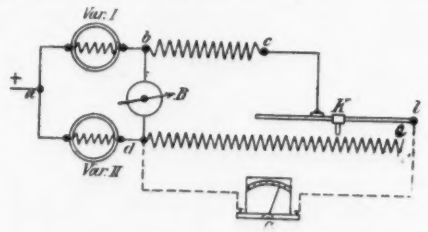



FIG. 11.—MEASURING VOLTAGES.

tension for comparison. It is supposed here, however, that the internal resistance of the voltmeter is not too small. The arrangement shown in Fig. 11 enables one to get independent values of the resistance and of the measuring current. It is a zero method. Variation resister, $I$, is in series with a constant resister, $b\,c$, of 1,200 ohms. If $I$ is designed for a current of 0.1666 amp., the voltage between $b$ and $c$ will be constant = 200, in spite of fluctuations of voltage in the network. The variation resister, $I$, consumes on the average 20 volts, i. e., if the network voltage varies between 210 and 230, the voltage consumed by $I$ will vary be-

tween 10 and 30. A second equal variation resister, *I I*, is in series with a resister, *d e*, of about 2,500 ohms. A simple galvanoscope, *B* (or a telephone in case of alternating current), is inserted between *b* and *d*. The voltmeter, *G*, to be calibrated is connected between *d* and the sliding contact, *K*, which is moved along a uniform resistor, *d e*, until the galvanoscope, *G*, shows zero current (or the telephone gives a minimum of sound). Then the voltage between *d* and *l* is again exactly 200 volts, since the influence of the change of voltage due to resistance of the voltmeter itself has now been eliminated. While this method permits only a comparison of voltages, the following arrangement shown in Fig. 12 allows a complete calibration and a measurement of voltages by the Wheatstone bridge method; *a* and *b* are two variation resisters, $r_1$ and $r_2$ constant resisters. The largest part of the voltage, however, is consumed by the constant resistance, $W_1$ $W_2$ and *R*, the latter one being adjustable within certain limits. In a bridge between *a* and *b* on one side and $r_1$ and $r_2$ on the other side, there is a galvanoscope, *B*, or a relay or indicator in case of alternating currents and a telephone. The voltmeter to be calibrated would be connected directly to the terminals of the instrument, as shown in the figure. There is also in the bridge a switch with three positions, 1, 2, 3. The instrument acts as follows: The two variation resistors, *a b*, carry a constant current, each of 0.15 ampere. A current of 0.3 ampere, therefore, passes through *R* and $W_1$ and $W_2$ from the positive to the negative terminal. This

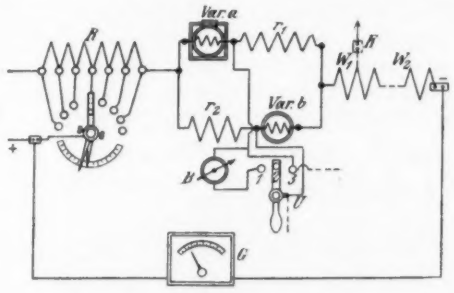



FIG. 12.—MEASURING VOLTAGES.

current divides itself between the different branches of the Wheatstone bridge. If each of the two variation resisters, *a* and *b*, consumed between 10 and 30 volts when carrying a constant current of 0.15 ampere, the mean e.m.f. of each variation resister will be 20 volts corresponding to a resistance of 133 ohms. If all the branches of the bridge are made equal the constant resistances, $r_1$ and $r_2$, are also each 133 ohms. With the proper mean voltage—220 volts—the e.m.f. consumed by *a*, *b*, $r_1$ and $r_2$ will be 20 volts in each case, so that the e.m.f. at the terminal of the bridge is 40 volts, while the balance of 180 volts is mainly consumed (say 160 volts) by the fixed resistors, $W_1$ and $W_2$, and to a smaller degree (about 20 volts) by the adjustable resister, *R*. If now the voltage between the two terminals is exactly 220, then the resistances in the four branches of the bridge are exactly equal and no current flows through the indicator, *B*, the switch, *U*, being in the position, 1. This would show that the voltage is correct, and the voltmeter, *G*, if accurate, would have to give a reading of 220 volts, whatever its internal resistance may be. If the voltage increases to 221, the excess e.m.f. of one volt would be consumed by the variation resistances, *a* and *b*, which each now consumes 21 volts, so that their resistance becomes 140 ohms. There is no longer equilibrium in the bridge, since $r_1$ and $r_2$ are only 133 ohms, and the indicator, *B*, will give a reading. By adjusting the resistance, *R*, the equilibrium may at once be reestablished so that *B* remains without current. For this purpurpose a change of resistance amounting to about 3.3 ohms is required. The resistance of *R* (designed for a change of 20 volts) must be about 66 ohms. It is, therefore, possible to read directly the voltage from a scale on *R*. With alternating currents the minimum of sound in the telephone enables one to get a very sharp reading. If switch *U* is placed on the position, 2, the resisters, $a + r_1$ and $b + r_2$ are simply connected in parallel. If there is no equilibrium in the bridge, another distribution of voltage between *a* and $r_1$ and between *b* and $r_2$ would take place in the case of short-circuiting the bridge by means of pushing the switch *U* to position 3. As long as *R* has not been correctly adjusted, movement of the switch *U* from 2 to 3 will cause variations in the brightness of these two variation resisters. It is, therefore, only necessary to adjust *R* until there are no longer any changes in the degree of brightness of *a* and *b* when the switch is changed from 2 to 3, and the voltage (for instance 222.4) may then be read directly from the scale of *R*. The degree of brightness of the variation resisters is, therefore, an optical means which makes any other measuring instrument like galvanoscope or telephone unnecessary in the bridge.—*Elek. Zeit.*, April 5.

### Telegraphy, Telephony and Signals.

*Oscillation Valve for Rectifying High-Frequency Currents.*—FLEMING.—An abstract of a (Brit.) Phys. Soc. paper. The author recalled the fact that as far back as 1890, when investigating the Edison effect in incandescent lamps, he had shown that the space between the carbon filament and an insulated metal plate placed in the vacuum bulb possessed a unilateral conductivity, negative electricity being able to pass from the filament to the plate, but not in the opposite direction. This led him to suggest an arrangement of the above kind for separating out or rectifying the oppositely directed waves in an alternating current. This effect is now recognized as due to the copious emission of negative ions or electrons from the incandescent carbon. In 1904, however, the author discovered that if the carbon filament in an electric incandescent lamp was surrounded with a metal cylinder connected to an insulated terminal by a wire sealed through the bulb, and if the filament was made incandescent by an insulated battery, then between the insulated terminal and the negative pole of the battery a unilateral conductivity existed which was operative with currents of any frequency, and the valve so made might be employed to render electrical oscillations measurable by an ordinary sensitive galvanometer. The author exhibited oscillation valves made on this plan, and also showed their uses. If placed in series with a galvanometer, and in the circuit of a coil of wire acted upon inductively at a distance by oscillations created in another circuit, the valve gives intrinsic information as to the damping in the primary circuit. The author referred to the employment of such carbon-filament oscillation valves as wave detectors or cymoscopes in connection with wireless telegraphy. Finally it was pointed out how, by the use of an electrodynamometer and galvanomter in series, the amount of rectification produced by the valve could be measured, and it was shown that it might reach 89 or 90 per cent.—Lond. *Elec.*, April 6.

## BOOK REVIEWS.

HIGH-TENSION POWER TRANSMISSION. Two Volumes. Vol. I, Papers and Discussions of the American Institute of Electrical Engineers, under the auspices of the Committee on High-Tension Transmission. Vol. II, Papers and Discussions at the International Electrical Congress, St. Louis. Cloth. New York: McGraw Publishing Company, Vol. I, 500 pages, illustrated. Price, $3.00. Vol. II, 315 pages, illustrated. Price, $2.50.

It was an apposite saying that the civilization of a nation might be measured by its consumption of iron, though a modern paraphrase would aver, as a little consideration shows, that civilization is more truly proportional to the consumption of energy.

We are all engaged in making things for others: taking some relatively undesirable form of matter and by the skillfully directed application of energy transforming it into some more valuable shape. Thus the miller and the waterfall grind grain into flour, which by the baker and oven's heat becomes bread. The spinner's arm twists the cotton fibre into thread that the flying shuttle, driven by the weaver's wrist interlaces into a garment. Through the fiery ordeal of the furnace the stony ore runs into molten metal, to be rolled into the pillars and girders that support a

palace. So matter is ever like Undine seeking energy as a soul to vivify it into usefulness. But energy is elusive and coy and difficult to decoy far from its chosen haunts in glancing waters of the cataract or the flickering flame of the fire. However, in electricity a Huldbrand has appeared and by its aid energy may be coaxed long distances away from its customary habitats and married to matter.

To accomplish this a special road must be provided, for electricity is royal and disdains all common paths and highways, even railways. Such a road the modern high-tension line provides, and of all of the engineering triumphs of the nineteenth century, probably few, if any, will exercise a more profound effect on future civilization than that closing achievement—the electrical transmission of energy over great distances.

To construct an adequate and sufficient electrical highway entirely transcended the experience of a quarter of a century ago. It presented new problems, demanded new materials, new processes of manufacture and the development of a new constructive skill along entirely novel and unfamiliar lines. There were no precedents and the electrical engineer, like his predecessors, had to feel his way blindly and stumblingly, through much painful evolution to the successful structure of to-day. In so young an art there has been little time to accumulate records, and the invaluable teaching of experience has existed chiefly in the minds and scattered notes of pioneer builders. To collect this information the American Institute of Electrical Engineers in 1902 appointed a High-Tension Transmission Committee, assigning to it the duty of securing in the form of papers and discussions a representative consensus of opinion as to standard practice in transmission line construction. The International Electrical Congress of St. Louis, 1904, afforded an opportunity to review this topic and subject it to the alchemy of the best engineering minds of both Europe and America; and now a publisher has collected the results of the deliberations of the High-Tension Transmission Committee and those of the Electrical Congress, in the what may be termed a general symposium of transmission line data.

Space would fail to adequately catalogue the papers and discussions, with the names of the authors, well known as authorities on this subject, so an idea of the scope and character of this work can be best gained by a brief consideration of the subjects it treats. It is equally impossible to attempt a critique in the ordinary book review sense, for as the papers are largely records of experience and simply truthful reports they are beyond criticism. In so far as they become prophetic, pointing the way to other constructors, they are based on records of past experience, and it is for the new designer to determine whether the data recited fit the cases with which he has to deal. There is no striving for literary effect. The writers have in all cases had something to say that is worth listening to, and have stated it tersely, to the point, and in plain engineering English—valuable attributes that more pretentious works might well copy.

The transmission line as a product of evolution has survived because it has successfully coped with the environment, and in its adjustment to circumstances the designer has been compelled to consider the laws of electricity so far as they bear on the transmission of energy; the limitations of constructive materials at command; the further limitations of those materials when in their manufactured conditions; and finally the question of competition with energy developed by other methods, for no engineering can be considered successful that is not remunerative. So in this collection of papers there appears a certain amount of theoretical matter, dealing with the questions of inductance, capacity, potential, frequency and wave forms in so far as these relate to transmission lines. It is gratifying to note that the authors have used the simplest language and have largely resisted the temptation to wander into higher mathematics. Next the various materials, such as copper and aluminum for conductors, glass, porcelain, etc., for insulators, wood and metal for pins, cross arms and poles are considered in the light of experience. Subsequently the limitations of manufacture are taken up, showing what experience has indicated as the best forms for transmission structural material.

There is perhaps less attention devoted to the commercial aspects of the electrical transmission of energy than the reader might desire, probably because so far most transmission lines have been located under circumstances that left no doubt as to commercial success; for naturally the most favorable locations would be first selected, leaving the narrower possibilities to a later period.

The volumes are fully illustrated both with photographic reproductions of actual conditions, and with line drawings of detail plans, and form the most complete and almost the only compendium of high-tension line practice. So they become a necessity to the transmission line engineer, and almost equally valuable to the library of every electrical engineer.

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Das Funken von Kommutatormotoren. By F. Punga. Hannover: Gebruder Janecke. 142 pages, 69 illustrations. Price, 4.60 marks.

In most treatises on dynamo-electric machinery, the subject of sparking at the commutator is dealt with in connection with direct-current motors, and is taken up again independently in connection with series alternating-current commutator motors. The author of this treatise has, however, presented the subject of sparking at commutators in its general relation to motors or dynamos of any type.

The engineering theory only has been attempted. That is to say, the author deals with the subject from an engineering standpoint as distinguished from the purely physical standpoint. Numerous arithmetical and practical examples are offered. The work includes a consideration of the direct-current motor, the series alternating-current motor, the repulsion motor and the compensated commutator motor. The treatment is clear and abundantly illustrated by vector diagrams. The book will be of special interest to the designer of commutator motors of all kinds.

## An Automobile Trip to Sell Motors.

By R. L. Caldwell.

I note that the Electrical World has been carrying on a vigorous campaign lately to increase the sale of current and the consumption of apparatus in the central station field. I think, therefore, that its readers might like to know what I did recently with my partner, Mr. Osterhoudt, on a novel automobile

AUTOMOBILE WITH SINGLE-PHASE MOTOR.

trip on Long Island, when with a "Century" single-phase motor mounted on the rear platform of the machine we spent several days in April traveling through the Island calling on central stations and giving a working demonstration of the motor's capabilities. As you are probably aware, this region has chiefly 60-cycle current, and in fact we encountered only one high-frequency plant, namely, that with 125 cycles, at Northport.

First we would call on the superintendent or manager at the main office of the company and get him deeply interested in

our motors. Then after considerable conversation, etc., we would surprise him by stating that if he would come outside with us we would go with him in our automobile to the plant and back our machine to the door and give a working demonstration of the motor, affording him the opportunity to use testing instruments with brakes, etc., so that he could judge exactly of the availability of the motor for his purposes. As our motors are built with an interchangeable winding, so that they can be operated on 104 or 208 volts, it was an easy matter to convince the managers of the many qualities embodied in the machine.

The novel way we had adopted of placing this machine before the different people interested was highly appreciated by them, and we believe the best exemplification of the fact that in order to sell goods you must display samples is shown by the success we achieved.

Our motor rode very easily on the machine, being mounted on the rear springs, and we lost no time due to its being there, as we ran rapidly over the roads, taking no notice of the ruts or rocks encountered. We thus subjected it to many a hard bounce, but found we were always able to give a highly satisfactory, practical demonstration without any adjustment owing to the fact that the motors are built very strong. The roads through Long Island as a general rule, however, are very fine, and the weather being excellent our trip was highly successful.

In addition to its being a fine advertising feature we had the pleasure of receiving orders and have shipped motors since. The expense entailed for this trip was very slight, being much lower than it would have cost us had we traveled by railroad, including only as it did hotel bills and the cost of oil and gasoline for operating the motor. I might add that as a precaution against bad weather the motor was encased in a rainproof and dustproof box, which, of course, was kept on it while traveling.

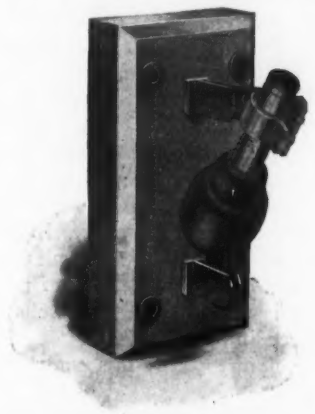
## New Style of High-Potential Fuse Holder.

The General Electric Company has perfected a new device in the shape of a high-potential fuse holder, shown in the accompanying illustration. These fuse holders are designed to protect 2,300 and 6,600-volt systems, but can be made to suit special requirements for higher voltage. They supersede the "expulsion" type and will be used in the future on all General Electric switchboards requiring high-potential fuses. The device is of small size and is claimed to be capable of rupturing more energy under short-circuit conditions than any other similar device heretofore placed on the market.

The body of the holder consists of an insulated metallic chamber, into the upper end of which is screwed a fibre tube. That part of the fuse located in the chamber is of smaller cross-section than the remainder, to insure rupturing at that point. The expansion of the gases formed by the arc in the chamber expels the fused metal and effectually opens the circuit. New fuses can be readily inserted in the holder by removing a screw plug located in the bottom of the bulb.

The holder is connected in circuit by means of blades fastened to either end, which fit into clips mounted on a base or switchboard panel. The advantages of this method of support will be readily understood. Spare fuse holders can be kept on hand ready for the instant replacement of ruptured fuses. The complete device is compact, substantial, easy to handle, and may be located in any convenient place. The holders are made in groups of two, three or four, mounted on bases or in single elements without bases for switchboard mounting.

It is recommended that 2,300-volt holders be spaced on 12-in. centers and 6,600-volt holders on 18-in. centers, unless barriers are used between them, in which case these distances can be made 5 in. and 8 in., respectively. The ampere rating corresponds to the direct-current carrying capacity, and the rupturing point is approximately 60 per cent greater. Fuses for operating on small overloads can be made to order. The 2,300 and 6,600-volt fuse holders are made to carry 100-ampere fuses or smaller



FUSE-HOLDER.

sizes. Holders of both voltages are made back-connected for switchboard use without bases, and either back or front-connected on base singly or in groups with barriers.

## Light and Power Plant for Los Angeles.

The Pacific Light & Power Company, of Los Angeles, Cal., has just contracted with Charles C. Moore & Co., engineers, of San Francisco, Cal., for the complete steam power plant to be delivered and installed at Redondo, Cal., on the ocean, a suburb of Los Angeles. This plant will be used for supplying power to the entire street railway system of Los Angeles and the various surrounding towns in connection with the various other power plants and water transmission systems. It will have a nominal capacity of 15,000 kw consisting of three 5,000-kw units; the overload capacity of plant will be about 30,000 indicated hp. The generating units consist of three McIntosh & Seymour combined double horizontal and vertical compound condensing engines, gridiron valve type, each direct-connected to a 5,000-kw fly-wheel General Electric 50-cycle, 18,000-volt alternator. The engines will operate under 175 lb. pressure, 100° F. superheat at throttle and 27½-in. vacuum. The engines, which are specially adapted for use with superheated steam, are equipped with powerful automatic shaft governors, and have a special equipment of electrical speed-changing devices and McIntosh patented time-delayed dashpots to facilitate the synchronizing of alternators and the operation of alternators in parallel under variable load. The division of load between the engines and the speed of each engine will be controlled by the switchboard operator. Each engine has two horizontal high-pressure cylinders and two vertical low-pressure cylinders; each engine has two sets of condensing apparatus, one for each low-pressure cylinder, so that in case of breakdowns of either side of any main engine the other side may be operated under an overload.

Wheeler Admiralty surface condensers are to be used throughout, supplied by the Wheeler Condenser & Engineering Company. Connected to each condenser there will be one motor-driven Wheeler centrifugal circulating pump and one Edwards triplex vertical single-acting suction valveless air pump, motor-driven. The air pump and circulating pump motors are supplied with power from an auxiliary generator, or may be operated from the main generator. Each main generator has its independent engine-driven exciter. The auxiliary engine and exciter engines are tandem-compound, non-condensing, supplied by the Harrisburg Foundry & Machine Works. The exhaust steam from the auxiliary engines, together with the various drips and the exhaust steam from the feed pumps will be used for feed water heating purposes. Steam is supplied by eighteen 600-hp Babcock & Wilcox water-tube boilers, each having integral superheater to give 125° superheat at the boiler nozzle when operating between 190 and 200 gauge pressure. Each boiler is equipped with a Peabody fuel oil furnace. Weber steel concrete chimneys will be used.

Chapman gate valves will be used throughout, specially con-

structed for use with superheated steam. Electrically-controlled valves will be used at critical points. On the outlet from each boiler there will be a Pearson automatic angle steam stop and check valve. Oil fuel is supplied to the boiler by means of Snow pumps, heated by Goubert multiflow oil heaters. The feed pumps are horizontal duplex compound, outside center packed. The feed water is heated by Goubert vertical multiflow feed-water heaters. The entire plant is designed on the panel system, being in effect three independent plants of 5,000 kw each.

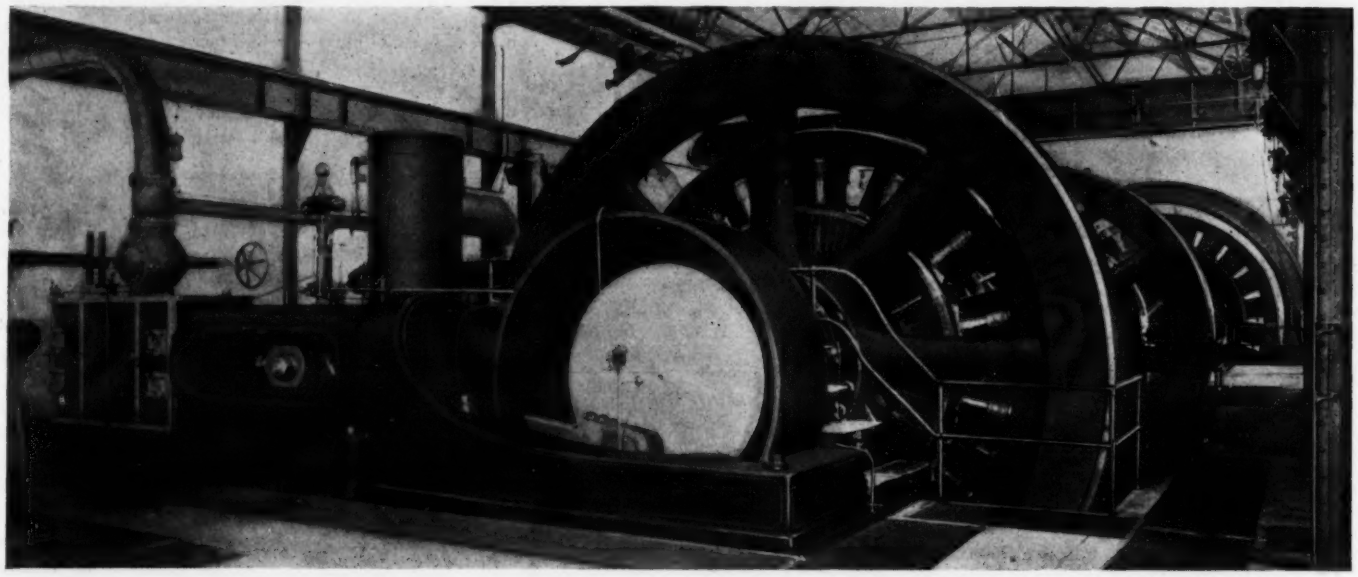
Heretofore the large steam plants on the Pacific Coast have been used in connection with water power transmission purposes, merely for purposes of reserve. In this instance it is the intention of the owners to operate the plant continuously by reason of the low cost of the production of power when using this plant. The plant is situated near the wells and oil will thus be secured at an exceedingly low rate.

One of the novel features of this contract is the provision for the contractors to operate the plant for a period long enough to insure all parts being in proper working order, and then to submit the plant to a 90-day test under actual working conditions, to determine the compliance with the guaranteed economy of the complete plant, the object being to determine the kilowatt-hours output of the plant swichboard per barrel of oil burned under the boilers.

tions into which the traction company's lines are divided. The engine room will be 50 ft. wide, extending the full length of the building, 170 ft., and directly facing Cameron Street. An electric traveling crane with a lifting capacity of 30 tons, will serve the engine room for installing heavy apparatus.

An interesting engineering feature of the new plant will be the water supply tunnel. Plans have been drawn and the work will shortly be started on the boring of a 5-ft. tunnel in the solid rock 30 ft. below the surface of the ground, extending from the plant in a direct line under the yards of the Central Iron and Steel Company to the river. From the river bank a 36-ft. cast-iron pipe will extend to a point in the river where the best quality of water is to be obtained. This water supply tunnel will be built and used jointly by the traction company and the Central Iron and Steel Company.

All the work is being carried out from plans prepared by and under the direction of Mason D. Pratt, consulting engineer, of Harrisburg, and W. C. Gotshall and C. O. Mailloux, of New York City, acting as advisory electrical engineers. This plant, the cost of which will approximate $250,000, is expected to be ready for operation during this month.



Railway Generators, New Power House of the Central Pennsylvania Traction Company.

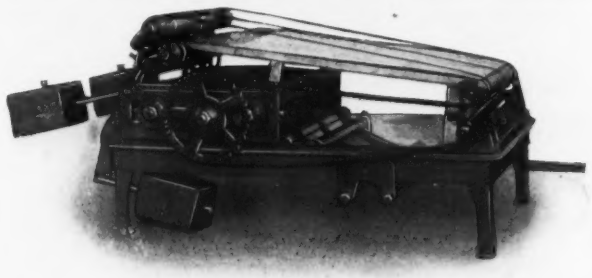
## Power House of Central Pennsylvania Traction Company at Harrisburg.

Excavations for the new power station of the Central Pennsylvania Traction Company of Harrisburg, Pennsylvania, were begun early in December and the construction of the building proper is now well on the way. The new plant adjoins the old No. 1 Station on South Cameron Street, Harrisburg, and when completed, will replace three separate plants which are now in service. The building, 175x102 ft. and one story in height, is of steel construction imbedded in concrete.

The steam and electrical equipment for the plant will consist of three Reynolds horizontal cross-compound, condensing, Corliss engines, heavy duty type, built at the West Allis shops of the Allis-Chalmers Company. Each engine will be direct connected to a 650-kw, 600-volt, direct-current generator mounted on the main shaft, the generators also being furnished by the Allis-Chalmers Company and built at its Bullock works, Cincinnati. These units will have a capacity of fifty per cent overload for short periods, giving a maximum capacity for the entire plant of approximately 4,500 hp. The main switchboard, which will consist of twelve panels, will be connected by a direct feeder line to each of the twelve different sec-

## The Crabb Transparentizer.

An original labor-saving device for draughting rooms and engineering departments of manufacturing plants and offices has been brought out by C. L. Crabb & Co., 21 Lincoln Place, Brooklyn, N. Y. This device is known as the Crabb "Transparentizer"



TRANSPARENTIZER.

and is shown herewith. The purpose of the device is to make it possible to dispense with tracings from original drawings, the latter being made serviceable for uses where tracings have heretofore been employed. The machine accomplishes this result through a combination of heated chemical bath and calendering rollers. Drawings made upon white paper with pencil are placed

on a feeder board between bands as shown. The bands convey the paper through the bath and between the calendering rollers, bringing it out again to the starting point. The operation consumes about 45 seconds and after it the drawing is at once ready for such uses as tracings would be ordinarily put. The treatment renders the paper as transparent as tracing cloth and blue prints made from it are said to be as clear as those obtained through the latter agency. A feature of the machine which should appeal to those who have experienced difficulty in preserving tracings is that the paper is made proof against water and mildew. The blue prints being made from the original drawing, the possibility of error due to tracing is eliminated. The maker claims that the paper is not shrunk by the treatment so that distortion of the drawing does not result, and that the machine is compact and simple in its operation. The bath and rollers may be heated by gas or by electricity, the machine shown being equipped with gas heaters.

## Lippincott Steam Indicating Apparatus.

The accompanying illustrations show a new line of indicating instruments made by the Lippincott Steam Specialty & Supply Co., Newark, N. J. Fig. 1 is a section cut of the high-pressure pattern instrument, which embodies several improvements. The piston is known as the frictionless, and as will be seen, is carried loosely between two ground flanges, which permit it to move laterally, and thereby centralize itself in the cylinder regardless of any side thrust of the spring. The rod is held central at the top in the usual manner, and also at the bottom by means of a tail rod and a bearing therefor.

The steam cylinder is readily removable, and is kept in perfect alignment by means of steam tight bearings at the top and bottom. Below the piston a number of steam ports are provided which admit live steam to the annular space surrounding the cylinder, thereby providing an efficient live steam jacket. The standard size piston is one-half inch area, but with each instrument is provided an extra cylinder and piston of quarter-inch area made of suitable material for gas engine and ammonia compressor work; the change of cylinders being effected in two minutes. The leakage of steam by the piston is taken care of by means of a swivel discharge of the elbow shown beneath the drum carrying arm, which elbow may be turned in any direction to suit the convenience of the operator.

FIG. 1.—SECTIONAL VIEW OF INDICATOR.

The pencil mechanism is made on a true pantographic principle which guarantees absolutely correctness. This mechanism is carried in an improved manner upon adjustable standards which admit of perfect alignment in every direction. A perfect detent motion is fitted to each instrument, as shown. The drum spring is provided with permanent heads at either end, and the top head fits over a square, milled on the end of the shaft, so that the tension of the drum spring may be varied to suit any desired speed. When desired, an outside spring attachment, as shown in Fig. 2, may be obtained, the body of the instrument remaining the same.

In Fig. 3 the Lippincott reducing wheel is shown attached

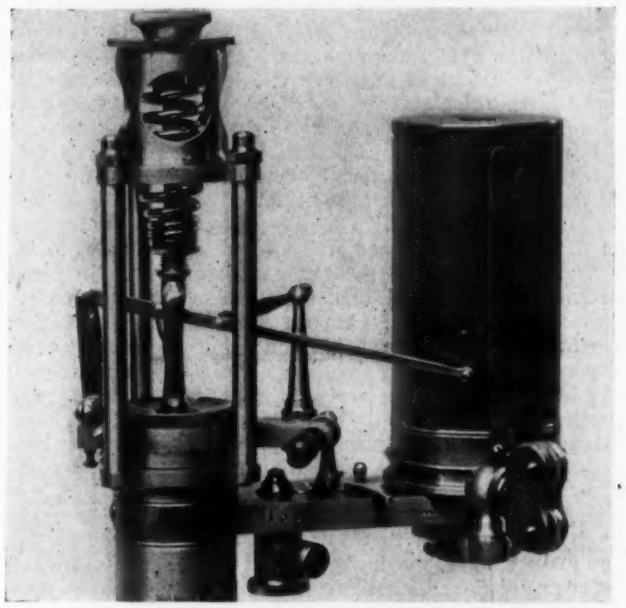


FIG. 2.—INDICATOR WITH REDUCING WHEEL.

to the indicator just described, but it may be attached to any standard make of indicator with equal facility, and is suitable for all strokes from 6 in. to 7 ft. The pulley, *E*, may be replaced by one of smaller size for longer strokes, and for very short stroke engines the main cord wheel, *C*, is removed from the hub, *F*, and another aluminum wheel of smaller size, which is provided with the instrument, is readily screwed into place, thus obviating the necessity for very large stroke bushings.

The guide pulley is carried on an arm which is attached to a nut of coarse pitch which travels on the threaded spindle, *D*, so that every revolution of the main cord wheel raises or lowers

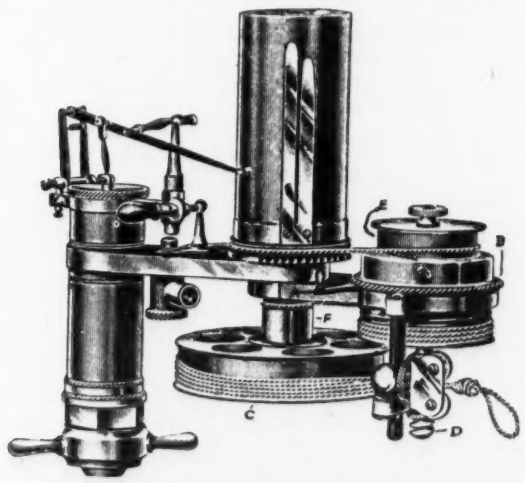



FIG. 3.—INDICATOR WITH SPRING ATTACHMENT.

the guide pulley a distance equal to the thickness of the cord, which prevents overlapping. The spring of this wheel is attached to a hub formed on a knurled disc, *B*, and by rotating this disc, which may be done even while the wheel is running, the spring tension may be increased to any desired extent. At the other end of the handle, *A*, is a double pawl which works in a substantial ratchet attached to the disc, *B*, and by vibrating this handle, one tooth of the ratchet is allowed to escape, which permits the release of the tension to any desired degree.

# Industrial and Commercial News

## Commercial Intelligence.

THE WEEK IN TRADE.—Weather conditions were favorable for retail trade and building operations, while the crop outlook was bright on the whole, although some sections reported delay to planting on account of excessive moisture, and there was much complaint regarding the scarcity of labor. Manufacturing plants are working to their full capacity in the leading industries, especially iron furnaces and steel mills, and there is little idle machinery at foot wear factories or textile mills. Railway earnings thus far reported for April surpass last year's by 8.2 per cent, and foreign commerce at the port of New York shows a gain of $938,619 in imports and a small loss of $283,619 in exports, as compared with the same week of 1905. Steel-making irons are firm, car and implement makers buying freely, but basic and foundry grades for forward delivery are weaker in competitive territory, the disposition being to make concessions. Consumption is heavy, and large orders, particularly from malleable founders and cast-iron pipe makers, are pending. Bessemer and open-hearth billets and sheet and tin bars are still scarce, the paucity curtailing production. New business in structural material is not especially marked, but good contracts are pending. Prices for 1907 have been reaffirmed. Thus far no large orders for San Francisco account have been placed, though it is probable that some business will develop. Implement makers have bought heavily of steel bars. Copper is in good demand for domestic consumption. All copper working interests are operating at maximum capacity, and with assurances of insistent markets through the year and beyond. Prices are firm, with indications of an early advance. Lake is 18¾ @ 18⅞c. for July and August delivery. Electrolytic is 18½c, 18⅝ @ 18¾c. for July, August and September. Casting copper, prime brands, thirty days' delivery, is 18¼ @ 18½c. *Bradstreet's* reports 177 business failures during the week ending April 26, against 167 the previous week, and 193 in the corresponding week last year.

THE NEW YORK GENERAL METAL WORKS, with general offices and sales department at No. 9 East Twenty-second Street, New York City, were incorporated on April 11, 1906, with a capital stock of $1,000,000. The business of the company is to manufacture some new kinds of metal goods. It has taken over the business of the Nonick Company, owned by Lewis Rodman Schultz, C. F. Marsh, James Paul Gaylord and Dr. James H. Burtenshaw, who, after years of experimenting, have perfected the inventions of C. F. Marsh, inventor of "Nonick China" and "Nonick Glassware." The new company also acquired the patents, plant and business of Dr. John A. Daly, inventor of "Architects' Bronze" and "Metal Lace." The New York General Metal Works are now looking for a suitable property within a radius of 25 miles of New York City, in order that they may increase their manufacturing facilities five or six times. There is acquired a large amount of special electrical machinery and appliances. The chief product of the works at the present time is "Architects' Bronze," and large orders are being filled for architects and builders for columns and capitals for the United States and Canada, and local work on hotels, theatres and other large buildings. The company makes electrically metal grills, balustrades, newel posts, doors and window frames and walls and ceilings, all of which being of seamless metal are fireproof. The form may be anything, the product is metal. The form may be retained or removed, and if the latter, the metal construction is sufficiently substantial for all requirements. The process is entirely different from electroplating, particularly in the absence of layers or strata in the deposit, and the tensile strength of the metal is increased, giving a uniform electro-deposit of a gauge to sustain any required strain, independent of the form upon which it is built. Metal lace introduces a novel and practical method of decorating and electrically illuminating ceilings, walls and windows. Any and all metals are employed in the manufacture of the product, and in any color finish, metals are capable of showing. The "Nonick" patents are for methods of protecting the edges of china dishes, cups and saucers, and glassware, by an indestructible and seamless rim, which is ornamental and sanitary. The loss caused by nicking and chipping and the wearing away of paint in the present china decorations is enormous. One prominent hotel in New York expends more than $100,000 per annum for this item of maintenance.

THE COPPER MARKET.—The "Copper Gossip" of the National Conduit & Cable Co., of New York, says with regard to the copper situation: "Nearly all producers are doing their best to increase output, and notwithstanding the big gain in production there is a phenomenal demand for large supplies. The dimensions of domestic requirements are astonishingly great, and very much of the consumption is due to the magnitude of electrical expansion. The orders for wire are simply immense, and nothing like the present demand for this class of partly manufactured product has been known before. There are important plans for building new electric railroads, and the extensive additions to be made to interurban traffic will necessitate the use of large quantities of copper. The electrical equipment arranged for by different companies will show in the consumption of copper wire bars for months to come, as the rapidly growing business in electrical goods has developed into most striking proportions. Every once in a while the question is raised whether consumption is actually using up the large production now taking place. While there is no way of arriving at absolutely definite conclusions on the subject, particularly since the official monthly returns of production were suspended a few years ago, there is nevertheless sufficient data available by means of which a fair knowledge of the facts may be approximately reached. The exact figures of exports and imports are a known quantity, but the amounts of copper produced and consumed are not so easily determined. It is true the latter may be closely estimated, but there is the possibility of error in the absence of official returns. Exports for the first three months of this year have averaged 35,497,280 pounds monthly. Imports for the first two months of 1906 average 17,673,600 pounds a month. Supposing production and imports to be 100,000,000 pounds per month the recent rate of exports would leave about 64,500,000 pounds a month for home use. Domestic consumption in 1905 is put at about 600,000,000 pounds, but we figure that there is greater activity among consumers this year than last year, if that could be possible. If, therefore, there is solid reason to believe that the mills and factories of this country are using as much as 64,000,000 pounds of copper each month then there would appear to be good ground for concluding that production is being pretty thoroughly absorbed."

THE CANADIAN WESTINGHOUSE, LTD., has been awarded a contract by the Montreal Street Railway Company for a large amount of apparatus. This was necessitated by the rapidly growing traffic of the company. The order included 20 quadruple equipments of railway motors complete with controllers and details; also a 1,000-kw, 600-volt, direct-current engine type generators for installation in its main power house, and three 500-kw, three-bearing, motor-generator sets, with 550-volt, direct-current generators. These latter are similar in capacity to those now installed in its various sub-stations, which feed directly into the trolley circuits. The Canadian Westinghouse Company, Ltd., is furnishing the T. Eaton Co., Ltd., of Toronto, a 300-kw, direct-current, 550-volt, engine type generator, to be used as part of its present large power plant, which is considered one of the most up-to-date direct-current plants in Canada, and is equipped throughout with Westinghouse apparatus.

WESTERN ELECTRIC ORDERS.—Among recent switchboard orders received by the Western Electric Company is one for a 35-panel, 2,200-volt board to be installed at Crystal City, Mo., at the new plant of the Pittsburg Plate Glass Company. The contract for the generating sets, to be installed in the new building at the corner of Clark and Adams Streets, Chicago, which will be occupied by the Commercial National Bank, has been awarded to the Western Electric Company. The installation consists of two 125-kw generators and two 200-kw generators.

ABNER DOBLE CO. RESUMES BUSINESS.—The Abner Doble Co., engineers and waterwheel manufacturers, of San Francisco, informs us that its works and offices at Fremont and Howard streets were entirely destroyed by the fire of April 18. Temporary offices have been opened up at the residence of President W. A. Doble, 2611 Broadway, between Scott and Devisadero streets, San Francisco, where the business of the company will be conducted for some little time. Immediately after the fire, steps were taken to erect new permanent shops on the block bounded by Seventh, Hubbell, South and Sixteenth streets, in the Potrero District, where the company had planned previous to the fire to erect large shops and warehouses. Work on the new shops has already been started, and the company is rapidly getting into shape to carry to completion the large contracts which it has on hand. Prominent among these orders is that with the government of Kashmir, British India, for the complete hydraulic installation of the Jhelum River power plant. The Abner Doble Co. is besides being manufacturer, dealer in all kinds of iron and steel, and it is Pacific Coast representative of several prominent firms in the East, including the Bethlehem Steel Company, Firth-Sterling Steel Company, Morse Chain Company, Falk Company, Electric Controller and Supply Company, Kohler Bros., etc. Manufacturers of machine tools, foundry and shop supplies and equipment, and dealers in similar lines are requested to send catalogues and price lists to the Abner Doble Company, 2611 Broadway, San Francisco.

ENGINEERS FOR SAN FRANCISCO.—We are advised that in response to the appeal of Mayor Schmitz, of San Francisco, for architects, draughtsmen and superintendents of building construction to assist in rebuilding the city, Hapgoods, the national organization of employing experts, with headquarters at 309 Broadway, New York, has offered its services without charge either to employer or employee and will work in close co-operation with the city authorities in finding suitable men to go there immediately. As soon as the Mayor's appeal was received, President H. J. Hapgood, issued instructions to the twelve offices of the company, throughout the country to institute a special search for the kind of men desired, and within a few hours lists of the names and addresses of a large number of experienced men available were telegraphed to San Francisco. The number of men who have thus far signified their willingness to go to the stricken city is by no means large enough to meet the demand which has been created by the announcement that the city will be at once rebuilt. Hapgoods has placed its services at the disposal of the people at San Francisco, and will be glad to hear at once from every competent architect, draughtsman or construction superintendent in this city or vicinity who would be willing to go to the coast. Full details concerning the opportunities offered will be supplied as soon as they are received from San Francisco.

A MACHINERY CONSOLIDATION.—The stockholders of the International Steam Pump Company have been called to a special meeting on May 8 to pass on an increase of the company's stock for the purpose of buying the stock of the Power and Mining Machinery Company, owned by Benjamin Guggenheim. The directors have already contracted to purchase the property from Mr. Guggenheim, and to pay for it it is the directors' purpose, if the stockholders approve, to issue $2,500,000 additional preferred and $5,500,000 additional common stock. The company is now capitalized at $12,500,000 preferred and $18,500,000 common stock. The Power and Mining Machinery Company has a plant at Cudahy, Wis., and its products, the directors of the International Company advise their stockholders, can be advantageously marketed with their own output. Mr. Guggenheim guarantees as a condition of the sale, according to the circular, that the net profits of his company in the next five years will aggregate at least $1,500,000. He further undertakes to act as chairman of the finance and executive committees of the International Steam Pump Company for the same period.

ALLIS-CHALMERS TROLLEY EQUIPMENT.—The Electrical Installation Company, Monadnock Building, Chicago, has been awarded the contract for the complete construction and equipment of the Indianapolis, Newcastle & Toledo Electric Railway Company's road. Work will begin immediately on the 43-mile division between Indianapolis and Newcastle. Allis-Chalmers Co.'s steam and electrical machinery and car equipments will be used. Among those interested in the company are D. M. Perry and W. E. Stevenson, of Indianapolis. The company's proposed system comprises 140 miles within the State of Indiana.

DUTY ON CARBONS.—The U. S. Customs Board of Appraisers, on the authority of a former decision on identical articles, has overruled the protest of R. F. Downing & Co., et al. on importations of carbon sticks intended for electric lighting. The importers contended that the sticks had to be cut to length and pointed to adapt them to use in electric lighting, whereas the articles in question were neither cut nor pointed, but were ½ to ⅝ inch in diameter and 12 to 28 inches long. Following an exhaustive opinion in a former well-known case, however, the board overruled the protest and affirmed the Collector's assessment of duty at 90 cents per hundred carbons.

BELL TELEPHONE OUTPUT.—The American Telephone & Telegraph Co.'s instrument statement for the month of March and since January 1, 1906, compares as follows:

| | 1906. | 1905. | 1904. | 1903. |
|---|---|---|---|---|
| March output ..... | 188,102 | 169,159 | 126,522 | 84,280 |
| Returned ..... | 66,596 | 47,645 | 35,043 | 38,172 |
| March net output..... | 121,506 | 121,514 | 91,479 | 46,108 |
| 3 months' gross output | 526,484 | 434,094 | 301,568 | 305,961 |
| Returned ..... | 178,662 | 132,922 | 108,990 | 116,646 |
| 3 months' net output... | 347,822 | 301,172 | 192,578 | 189,315 |
| Total outstanding .... | 6,046,080 | 4,781,736 | 3,972,095 | 3,339,653 |

This would give a total of 3,023,040 complete sets outstanding, or probably not far short of 2,500,000 subscribers.

TELEPHONE COMPANY RECEIVERSHIP.—The Court of Chancery last week at Trenton, N. J., appointed Charles M. Myers, of Newark, receiver for the Telegraph and Telephone Company of America, a large holding company, with $30,000,000 capital stock. The liabilities are placed at $925,562, made up largely of unpaid assessments on stocks. The assets are nominally $2,051,171. These are of uncertain value, it is said, because they are composed of stocks and bonds of subsidiary companies, most of which are inactive.

TELEPHONE CONSTRUCTION AT INDIANAPOLIS.—The Central Union Telephone Company has purchased the old church property, corner Meridian and New York Streets, Indianapolis, upon which it proposes to build at once an eight-story office and exchange building. In addition to this, the company has taken out building permits for the construction of three sub-station buildings in various parts of the city to cost $12,000 each. It is expected that these improvements will greatly improve the company's service.

ROBINS BELT CONVEYING COMPANY, Park Row Building, New York, has completed recently the entire cable road and hoisting tower coaling plant of the Long Island Railroad power station of the Pennsylvania Railroad Company; and the coal handling plant at the Marion station of the Public Service Corporation of New Jersey.

STEEL RAIL FOR BAHIA.—The United States Steel Products Export Company, which handles the foreign business of the United States Steel Corporation, will begin this month to carry out a contract for 7,000 tons of rail to be used in the construction of the electric traction system at Bahia, Brazil.

SAN FRANCISCO STANLEY OFFICES.—The Stanley-G. I. Electric Manufacturing Company has opened temporary offices at 67 Blake Block, Oakland, Cal. Several car loads of electrical apparatus have already left Pittsfield to take the place of machinery damaged or destroyed in the great catastrophe.

WIRELESS FOR STEAM YACHTS.—Mr. Paul J. Rainey has closed a contract with the Atlantic De Forest Wireless Company for the installation of its system on his steam yacht *Anona*. This, it is said, will be the first American steam yacht equipped with wireless.

BARNS AND SHOPS FOR CHICAGO.—The Chicago City Railway has bought three large tracts in Englewood and two corners at Seventy-ninth Street. It is spending $100,000 in car barns and shops.

## *Financial Intelligence.*

THE WEEK IN WALL STREET.—The stock market was under pressure throughout the week, but rallied slightly after severe and general declines, caused by liquidation and bearish selling as an aftermath of the San Francisco disaster, presumed sales of securities by insurance companies being the chief disturbing factor. Money market conditions were, however, easy as a result of further large gold imports, enabling New York banks to supply money for San Francisco without strain. The United States Steel stocks shared in the general decline, but the excellent report of the company for the March quarter had a

good effect in steadying these securities. On Friday, however, there was renewed selling of high-grade dividend-paying railroad shares, such as Great Northern, Northern Pacific and St. Paul, and the presumption was that fire insurance underwriters were actually liquidating. This caused a further assertion of bearish sentiment in the market, and prices in some cases reached the lowest level they have touched in some time. Traction stocks were the greatest sufferers in the decline in electric securities, Brooklyn Rapid Transit losing 11⅛ points net, the range of quotations being between 84½, the highest, and 72¾, the lowest. Metropolitan Street Railway declined 4 points net, closing at 111, and Interborough-Metropolitan common 1¼, the closing quotation being 50; while preferred closed at 85, also a net decline of 1¼ points. Allis-Chalmers common closed at 20½, a decline of ¾ point, and General Electric lost 6½ points, closing at the lowest quotation of the week, 162⅝. Western Union Telegraph closed at 93, a net gain of ⅞. There was general liquidation in outside securities, with all-around breaks, but the declines were less severe than on the exchange. The copper group was the worst sufferer. Following are the closing quotations of May 1:

NEW YORK

| | Apr. 24 | May 1 | | Apr. 24 | May 1 |
|---|---|---|---|---|---|
| Allis-Chalmers Co. | 20⅛ | 20⅝ | General Electric | 166⅛ | 163 |
| Allis.Chalmers Co. pfd. | 56¼ | 55½ | Hudson River Tel. | ... | ... |
| American Dist. Tel. | *39 | *39 | Interborough Rap. Tran. | 226 | 221 |
| American Locomotive | 64½ | 58 | Mackay Cos. | 63¼ | 62 |
| American Locomotive pfd. | 113⅜ | 111 | Mackay Cos pfd. | 72¾ | 71 |
| American Tel. & Cable | 92 | 90 | Marconi Tel. | ... | ... |
| American Tel. & Tel. | 137½ | 131 | Metropolitan St. Ry | 112⅛ | 109 |
| Brooklyn Rapid Transit | 81⅛ | 74 | N. Y. & N. J. Tel. | ... | ... |
| Electric Boat | 18 | 18 | Western Union Tel. | 92¼ | 91¼ |
| Electric Boat pfd | 65 | 65 | Westinghouse com. | 156 | 140 |
| Electric Vehicle | 15⅛ | 15⅛ | Westinghouse pfd. | ... | ... |
| Electric Vehicle pfd. | 17⅜ | 17⅜ | | | |

BOSTON

| | Apr. 24 | May 1 | | Apr. 24 | May 1 |
|---|---|---|---|---|---|
| American Tel. & Tel. | 137½ | 132¾ | Mass. Elec. Ry. pfd | 66 | 66 |
| Cumberland Telephone | ... | ... | Mexican Telephone | ... | ... |
| Edison Elec. Illum. | ... | 245 | New England Telephone | 138⅛ | ... |
| General Electric | ... | 165 | Western Tel. & Tel | ... | ... |
| Mass. Elec. Ry. | 18⅛ | 18 | Western Tel. & Tel pfd. | ... | ... |

PHILADELPHIA

| | Apr. 24 | May 1 | | Apr. 24 | May 1 |
|---|---|---|---|---|---|
| American Railways | 52 | 57⅜ | Phila. Electric | 8¼ | 7⅞ |
| Elec. Co. of America | 11¼ | 11¾ | Phila. Rapid Trans. | 27⅝ | 25⅜ |
| Elec. Storage Battery | 75 | 71 | Phila. Traction | 99 | 98⅜ |
| Elec. Storage Battery pfd. | ... | .. | | | |

CHICAGO

| | Apr. 24 | May 1 | | Apr. 24 | May 1 |
|---|---|---|---|---|---|
| Chicago City Ry. | 150 | 145 | National Carbon | 90 | 90¼ |
| Chicago Edison | ... | ... | National Carbon pfd. | 120 | 118 |
| Chicago Subway | 55¼ | ... | Union Traction | ... | ... |
| Chicago Tel. Co. | 107½ | ... | Union Traction pfd | ... | ... |
| Metropolitan Elev. com. | 26 | 26⅛ | | | |

* Asked

MANILA ELECTRIC EARNINGS.—The first annual report of the Manila Electric Railroad & Lighting Company for the twelve months ending December 31, 1905, shows the subjoined results:

| | | |
|---|---|---|
| Gross earnings: | | |
| Light and power | $328,417 | |
| Railway | 347,316 | |
| Trucking | 47,793 | |
| | | $723,526 |
| Operating expenses: | | |
| Light and power | $168,458 | |
| Railway | 165,234 | |
| Trucking | 36,285 | |
| | | 369,978 |
| Net | | $353,547 |
| Miscellaneous sources | | 1,122 |
| Net income | | $354,670 |
| Interest on bonds | | 195,109 |
| Surplus for 12 months | | $159,561 |

The railway service went into operation April 10, 1905, so that the figures for the railway cover less than nine months.

MASSACHUSETTS ELECTRIC LIGHTING.—The twenty-first annual report of the Massachusetts Board of Gas and Electric Light Commissioners gives the subjoined comparative figures as to the earnings of the electric light systems of the State:

| | | | | |
|---|---|---|---|---|
| Gross | $8,108,265 | $7,663,961 | $7,206,189 | $6,642,309 |
| Expenses | 4,777,248 | 4,632,043 | 4,638,991 | 4,109,816 |
| Net | $3,331,017 | $3,031,918 | $2,567,198 | $2,532,493 |
| Ded. gas prof. | 634,690 | 515,579 | 425,179 | 389,572 |
| Balance | $2,919,340 | $2,516,339 | $2,142,019 | $2,142,921 |
| Other inc. | 223,012 | 491,876 | 85,745 | 420,838 |
| Total inc. | $3,242,352 | $3,008,215 | $2,227,764 | $2,563,759 |
| Charges | 1,523,300 | 1,929,782 | 1,102,111 | 1,626,015 |
| Balance | $1,396,040 | $1,078,433 | $1,125,653 | $937,744 |
| Dividends | 1,489,247 | 1,543,775 | 1,225,480 | 1,207,458 |
| Surplus | $93,207 | *$465,342 | *$99,827 | *$269,714 |

*Deficit.

The gas companies earned gross $9,885,674 and $2,739,145 net on operation.

GEORGIA RAILWAY AND ELECTRIC is doing very well. The earnings of the first quarter of the current year were $676,302, compared with $550,108 in the same period of 1905. This is a gain of $125,294, or 22.78 per cent, and net earnings show considerably large percentage of increase. Many improvements and betterments have been effected to meet the growing needs of Atlanta, and last year alone there was expended for improvements and betterments about $300,000 from earnings equivalent to nearly 5 per cent. on the common stock. All the important lines in the city proper are double-tracked, but single-track lines running outside the city limits are found inadequate and the management proposes double-tracking several of these lines this year. This, with certain minor improvements, is expected to cost about $600,000, and this amount will be largely supplied from earnings. The lighting system is in excellent shape, also.

HUDSON RIVER POWER.—George N. Freeman and others of Troy have conveyed to Elmer J. West, of Glens Falls, the property on the north side of the Hudson River, near Glens Falls. The purchase consists of a hundred or more acres, with a river frontage of about three miles, and is the Zenas Van Duzen sawmill property. The State maintains a dam at this point for the purpose of supplying the summit levels of the Champlain Canal, and a head of eighteen feet is obtained. The purchase carries the right to the surplus water of the river, and it is estimated that by hydro-electrical development 5,000 horsepower can be obtained. The generating station will be linked with the Hudson River Electric Power Company's transmission lines, and will add its quota.

MASSACHUSETTS ELECTRIC BONDS.—The constituent companies of the Massachusetts Electric Cos. have sold to a syndicate composed of H. W. Poor & Co., Hayden, Stone & Co. and Bond & Goodwin $2,048,000 4 per cent refunding bonds as follows: $932,000 4 per cent Boston & Northern refunding bonds dated July 1, 1904, and maturing in 1954; $1,116,000 Old Colony refunding bonds dated July 1, 1904, and maturing in 1954. The entire proceeds are to be used in retiring the floating debt of the two companies incurred for betterments, equipment and new construction. The bonds are issued under a general blanket mortgage which authorizes a total of $15,000,000 bonds for the Boston & Northern and $10,000,000 for the Old Colony.

TELEPHONE MERGER AT FORT WAYNE.—The final steps are being taken for the merger of the Home and National Telephone Companies, of Fort Wayne, Ind. The capital stock of the merger company, to be hereafter known of the Home Telephone Company is to be $600,000, of which $100,000 is to be put upon the market to raise funds for extensions of the toll lines. One of the extensions is to be a direct line to Indianapolis so as to care for the large volume of business now refused because of inadequate facilities. Application has been made already for $25,000 of the new issue of preferred stock at par. The Home Company directors have just paid a semi-annual dividend of 1½ per cent.

PEEKSKILL GAS AND ELECTRIC.—The Peekskill, N. Y., Lighting & Electric Company, capitalized at $1,400,000, and furnishing gas and electricity to Peekskill on the Hudson, and operating ten miles of electric railroad, has been acquired by interests associated with F. A. Stratton, of Westchester County. A merger with the Northern Westchester Lighting Company, of which Mr. Stratton is president, is a possibility. Mr. Stratton was formerly president of the Westchester Lighting Company, now controlled by the Consolidated Gas Company.

MEXICO CITY TROLLEYS.—The Mexican Tramway Company, which has been formed by Canadian capitalists to take over the tramway lines of the City of Mexico from Messrs. Wehrner, Beit & Co., is offering $8,000,000 bonds at 90 with 35 per cent bonus stock. The entire amount was first underwritten by a syndicate most of the members of which are directors of the Mexican Light & Power Company.

INTERNATIONAL STEAM PUMP.—Directors of the International Steam Pump Company have decided to increase the capital stock of the company by the issue of 55,000 shares of common stock and 25,000 shares of preferred stock, bringing the total capital stock from $31,000,000 up to $39,000,000.

THE CHAMBLY DAMAGES.—The Montreal Light, Heat & Power Company has been condemned to pay the Quebec government $40,000 damages caused by the disasters to the company's big dam at Chambly.

GRAND RAPIDS-MUSKEGON POWER.—Perry, Coffin & Burr are offering $700,000 of the Grand Rapids-Muskegon Power Co. first mortgage 5 per cent gold bonds. The new power development will consist of a series of large storage reservoirs and masonry dams of 30 to 40 feet in height. The first development of 6,000 hp has already been completed at Big Rapids, and within a year a second station of 16,000 hp will be completed further down the river at a place called Croton. The cost of the Croton station will be materially reduced by the use of electric power for the operation of all construction machinery and the further fact that the bulk of the materials for construction are obtainable in the immediate vicinity. The Big Rapids station is equipped with the most modern, direct-connected machinery and high efficiency waterwheels of the latest design, and the equipment of all additional stations will be of equally high standard. In anticipation of the completion of the Croton plant, the steam stations of the two interurban lines above mentioned will be operated under lease to generate power in addition to that now being developed at Big Rapids. The company is now delivering power in Muskegon and Grand Rapids over high-tension transmission lines located upon private right of way, and operates under ample and satisfactory franchise rights extending well beyond the maturity of its first mortgage bonds. It owns practically all the water power rights on the Muskegon River, capable of 50,000 hp and all within 60 miles of Grand Rapids. A number of large contracts for the sale of power have been made, including contracts for all the current required in operating the interurban lines between Grand Rapids and Holland, and Grand Rapids, Grand Haven and Muskegon. The steam stations of these interurban lines have been leased by the Power Company and will be used until the second water power plant of 16,000 hp, now being constructed, is ready for operation. The actual cash investment over and above the bonded debt of the company is $600,000, and the company estimates that its annual net earnings from the sale of the 6,000 hp at Big Rapids, after paying all operating expenses and taxes, will be sufficient to pay over two and one-half times the annual interest charged on the $800,000 bonds now outstanding.

DIVIDENDS.—The directors of the Central District & Printing Telegraph Company declared the usual dividend of 2 per cent, payable April 30, to stock of record April 23. The directors of the Consolidated Gas Company have declared a dividend of 1 per cent on the stock, compared with 2 per cent in the previous quarter. The dividend is payable June 15. This cuts the dividend rate in two as a result of 80 cent gas. The directors of the Cambridge, Mass., Electric Light Company have declared a regular quarterly dividend of 2½ per cent, payable May 1. The Missouri & Kansas Telephone Co. has declared a regular quarterly dividend of 1½ per cent. The directors of the Georgia Railway & Electric Co. have declared a dividend of 1½ per cent upon the common stock, payable May 19, to stock of record May 15. This is an increase in the dividend rate from 4 per cent to a 6 per cent basis yearly. Directors of the Toledo Railways & Light Company have declared the regular semi-annual dividend of 1 per cent, payable May 3. The directors of the Pennsylvania Bell Telephone Company have declared the usual quarterly dividend of 1½ per cent, payable May 1. The Ohio Traction Company, of Cincinnati, has declared the regular quarterly dividend of 1¼ per cent, payable May 1. A semi-annual dividend of $5 per share has been declared, payable May 15, 1906, on the capital stock of Tampa Electric Company, to stockholders of record May 5. The directors of the Ashton Valve Company have declared the regular quarterly dividend of 1½ per cent, payable May 15.

ELECTRIC COMPANY OF AMERICA has issued its annual report as follows for the year ended December 31, 1905:

| | 1905. | 1904. | 1903. | 1902. |
|---|---|---|---|---|
| Net | ..... | $465,402 | $418,893 | $366,588 |
| Other income | ..... | 5,163 | 15,726 | 26,955 |
| Total income | $539,190 | $470,565 | $434,619 | $393,543 |
| Charges to sub. cos. | 42,654 | 29,064 | 8,359 | 8,432 |
| Balance | $496,536 | $441,501 | $426,260 | $385,111 |
| Exp. of management | 55,605 | 32,598 | 27,281 | 32,632 |
| Balance | $440,931 | $408,903 | $398,979 | $352,479 |
| Dividends | 285,505 | 244,719 | 244,716 | 203,979 |
| Surplus | $155,426 | $164,184 | $154,263 | $148,500 |
| Previous surplus | 772,223 | 608,039 | 453,776 | 916,194 |
| Total | $927,649 | $772,223 | $608,039 | $1,064,694 |
| Extra div. | ..... | ..... | ..... | 610,918 |
| Surplus | $927,649 | $772,223 | $608,039 | $453,776 |

WASHINGTON TELEPHONE EXCHANGE.—The Chesapeake and Potomac Telephone Company is about to break ground for the erection of a three-story and basement brick and stone exchange building at 629 B Street Northeast, Washington. This building will be utilized chiefly as a central office building, although there will be accommodations for branches of the contract and construction department. In this building will be placed a central energy switchboard of the latest type, large enough to accommodate 20,000 or 25,000 subscribers. Besides the operating room, which will contain the switchboard, there will be rest and retiring rooms for the operators, a dining-room, etc. The building will cost $100,000, and the equipment approximately $300,000 more. The contract for building has been let to John McGregor, of Washington.

EARNINGS AT SAO PAULO, BRAZIL.—The Sao Paulo Light & Power Co., of Brazil, operated by Canadian and American interests, has issued its annual report for the year ended December 31, 1905. The income account compares as follows:

| | 1905. | 1904. | 1903. | 1902. |
|---|---|---|---|---|
| Total gross earnings | $1,908,406 | $1,419,338 | $1,303,175 | $1,123,285 |
| Expenses and taxes | 669,932 | *477,556 | *403,747 | *417,916 |
| Net | $1,238,474 | $941,782 | $899,428 | $705,369 |
| Charges | 275,847 | 293,782 | 286,885 | 250,000 |
| Surplus | $962,627 | $648,000 | $612,543 | $455,369 |
| Dividends | 599,594 | 520,027 | 391,379 | 239,019 |
| Surplus | $363,033 | $127,973 | $221,164 | $216,350 |

*Taxes not included.

TELEPHONY IN MINNESOTA.—The Twin City Telephone Company, of Minneapolis, has transferred all its property to the Tri-State Telephone & Telegraph Company, for $4,000,000. This is an amalgamation of the two companies. The Twin City is the Minneapolis urban operating company, and the Tri State has been its country and long-distance connection. The Twin City had $1,500,000 stock and $1,000,000 bonds outstanding. The Tri-State is capitalized at $6,000,000. The Twin City stock had paid seventeen quarterly dividends at the rate of 7 per cent. per annum, and the Tri-State stock bears 6 per cent. Under the new plan $1,000 in shares of the Twin City will go into the Tri-State at a valuation of $1,117.67. Territorial extensions are proposed.

CONSOLIDATION AT MEMPHIS.—Isadore Newman & Son, of New York, are proposing to form a holding company with $20,000,000 common stock and $20,000,000 preferred, to take over the street, car and light properties of the Newman group in Memphis, Nashville, Birmingham, Knoxville, Little Rock and Houston. The stock issues of the properties amount to $8,745,000 common and $13,000,000 preferred. A schedule is submitted to the stockholders, giving a basis of exchange. The firm has expended large sums in improving the properties and it is supposed it proposes to issue stock to cover the entire expenditure.

INDIANA TELEPHONE MERGER.—A special dispatch from Wabash, Ind., of April 29, says: The merger of important Indiana telephone companies, controlling a dozen exchanges and 500 miles of line, has just been agreed upon and at a meeting to be held at Fort Wayne the Telephone Company of Indiana, with $5,000,000 stock and $5,000,000 bonds, will be organized. The independent companies take bonds and stock in payment of the purchase price. This is the forerunner of the combination of northern Indiana independent exchanges by the St. Louis syndicate which has options on the property.

CHICAGO PNEUMATIC TOOL.—The Chicago Pneumatic Tool Co. reports for first quarter of 1906: Profits, $233,332; less depreciation, etc., $36,327; bond interest, $28,750; sinking fund $12,500. Left for dividend, $155,744; less dividend, $61,087; balance for surplus, $94,656. Total surplus, $605,949. The net profit available for dividends is at the annual rate of 10.20 per cent, as compared with 9.82 per cent for same quarter of 1905.

CHICAGO ELEVATED BONDS.—This week the South Side Elevated, of Chicago, will deliver to the syndicate headed by the Illinois Trust Co., $1,500,000 more first mortgage 4½ per cent bonds, the proceeds of which are being used for extensions. The amount voted was $8,000,000. This will leave $1,000,000 unissued.

PHILADELPHIA KEYSTONE TELEPHONE.—The Keystone Telephone Company, of Philadelphia, reports March business as follows: Gross, $69,730; net, $29,146; surplus over charges, etc., $5,452. Nine months gross, $604,772; net, $271,849; surplus over charges, etc., $60,601.

# GENERAL NEWS.

## Construction Notes.

MOBILE, ALA.—A syndicate headed by the H. M. Byllesby & Company, of Chicago, Ill., has purchased the electric light plant of the Electric Lighting Company, of Mobile. It is stated that the new management will make immediate improvements and extensions to the system. The company has already placed orders for additional equipment to the plant which includes two 500-hp water-tube boilers, two 500-kw steam turbines and additional condensing apparatus, switchboards, etc. S. C. Schaffner, the present superintendent, will be retained by the new management. C. E. Groesbeck, constructing engineer for H. M. Byllesby & Company, will have charge of the construction work.

HOPE, ARK.—The Hope water and light plant contemplates installing a fan system soon. Charles M. Richards is superintendent.

ANAHEIM, CAL.—At a recent election the citizens voted to issue $23,000 for water works and $25,000 for an electric light plant. A. L. Lewis is engineer.

SAN FRANCISCO, CAL.—The North Beach generating station of the United Railroads was out of the fire zone and electric car service was resumed on Fillmore and Devisidero Streets to Golden Gate Park, April 23, after four days of suspension.

UKIAH, CAL.—Arrangements have been made by the Board of Trustees with the Snow Mountains Power & Water Company to furnish power to the city electric lighting plant as soon as its transmission line is completed. The company expects its plant completed and in operation by November, 1906.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company is making every possible effort to resume lighting service, as soon as it is considered safe. Large gangs of men have been put to work on overhead wires and underground conduits. Although every one of the sub-stations taken over from the Independent Electric Light & Power Company on the alternating-current system were burned, it is found that the 11,000-volt underground cables leading from the undamaged main generating station in the Potrero District to the master sub-station at 8th and Mission Streets were intact. New transformers only are needed to resume business. The fated Jessie Street station, between 3rd and 4th Streets, was again a victim to fire, after being damaged by the earthquake. Additional motor generator sets are being constructed for this station. F V. T. Lee, assistant to the general manager, is doing all in his power in co-operation with other officials to rehabilitate the city system.

BOULDER, COL.—It is reported that the Boulder Electric Light & Power Company has sold its property to the Henry Company of New York City.

CRESTED BUTTE, COL.—A special election will soon be held to ratify the action of the Council in regard to the purchase of the plant of the Crested Butte Light & Water Company. The company has agreed to sell the plant to the town for $24,000 to be paid in installments.

BRIDGEPORT, CONN.—The New York, New Haven & Hartford Railroad Company will soon begin the work of installing a large lighting and power plant in the new station here. It will furnish power to operate the elevators and rolling lift bridge, and will also light the interiors and platforms of the stations and the wharves from Stratford Avenue south to the Naugatuck dock, including the railroad and steamboat sheds. The company has a contract for one year with the United Illuminating Company to furnish light and power, which will soon expire.

GLASTONBURY, CONN.—Work will soon begin on the construction of the hydro-electric plant of the Glastonbury Power Company. Lewis W. Ripley is treasurer.

WILMINGTON, DEL.—Work has commenced on the construction of the new power house of the Wilmington Traction Company. J. and T. Oliver have the contract for construction of the building.

WASHINGTON, D. C.—The Chesapeake and Potomac Telephone Company has let the contract for the erection of its new eastern exchange to John McGregor, of this city. The building will cost $100,000, and will be located at 629 B Street northeast. It will have an equipment costing more than $300,000, making a total investment of $400,000 to $500,000.

WASHINGTON, D. C.—The Winchester and Washington City Railway Company will, according to reports, supply power to the Shenandoah Ore & Iron Company, recently chartered, and that a railway will be built from the mines of the company to Millville, W. Va.

WASHINGTON, D. C.—Bids will be received until May 22 at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the Navy Yards, at Mare Island, Cal., and Puget Sound, Wash., naval supplies as follows: Schedule 527—Transformers, steel plates, tool steel, safety valves, etc. Schedule 528—Searchlights, pig iron. Schedule 529—Motor, motor hoists, cylinder, dynamo, expanded metal, bar steel, American and Norway bar iron, etc. Applications for proposals should designate the schedule desired by number. H. T. B. Harris, Paymaster-General, U. S. N.

ATLANTA, GA.—The Georgia Railway & Electric Company will expend about $20,000 in remodeling its building on Alabama Street.

LAGRANGE, GA.—The new electric lighting and power plant, owned by the city, has been completed and is ready to take the place of the old plant.

TALLAPOOSA, GA.—Rapid progress is being made on the electric lighting plant for the city. A. J. Radcliffe is superintendent of construction.

ALTUS, GA.—The McQuatters Plumbing & Machine Company, of Hillsboro, Tex., has secured the contract for water works and an electric light plant, for $28,000.

DUBLIN, GA.—A petition has been filed by the owners of the Dublin Telephone & Manufacturing Company to change the name to the Dublin Telephone & Telegraph Company.

MACON, GA.—Atlanta and Macon capitalists are figuring on a new electric plant at Macon. The city is at present lighted by the Macon Railway & Light Company, at $75 per lamp per year.

ATLANTA, GA.—The surveying corps of the Georgia Railway & Electric Company is mapping out the route proposed for the new suburban line between Atlanta and Stone Mountain, a distance of 11 miles.

ATLANTA, GA.—The North Georgia Electric Company has secured franchises for the distribution of electric power throughout the city. Its power is transmitted by a tower line from the shoals at Gainesville, about ninety miles distance. The company will put up a building here to cost $15,000.

BUSHNELL, ILL.—The Bushnell Electric Light & Power Company has just completed extensive alterations to its plant.

AURORA, ILL.—The Independent Telephone & Telegraph Company has petitioned for a franchise for entrance into Chicago.

LINCOLN, ILL.—Contracts have been let for much of the work of the Springfield-Lincoln branch of the Illinois traction system.

VIRDEN, ILL.—The Virden Electric Light Company has made arrangements to enlarge its plant and also its scope of business.

PANA, ILL.—The Southwestern Traction Company, recently organized, will construct an electric railway connecting Springfield and Pana.

JOILET, ILL.—The City Council has granted a fifty-year franchise to the Joilet & Southern Traction Company and the Channahon Light & Power Company.

BLOOMINGTON, ILL.—Geo. K. Marsh has offered to the City Council $10,000 a year for twenty years for a franchise to operate a street railway in this city.

GALESBURG, ILL.—The People's Electric Power Company has asked for a franchise to operate an electric plant and power house for the purpose of furnishing light, heat and power to this city.

CAIRO, ILL.—Mulcahy & Yates will petition the county board of Alexander County for right-of-way along the eastern side of the county road from the city limits of Cairo to the Cache bridge, for an interurban railway.

CANTON, ILL.—Contracts between the Illinois Central Electric Railway Company and the Cleveland syndicate have been signed for the construction and operation of an electric interurban between Canton and Lewiston.

CAPRON, ILL.—At a recent meeting of the stockholders of the Capron Home Telephone Company it was voted to increase the capital stock to $10,000. A central will be established in Capron and work will soon begin on the lines.

CHICAGO, ILL.—Bids will be received until June 13 by the Board of Trustees Sanitary District of Chicago, for furnishing transmission line poles along the right of way of the said Sanitary District. Bids will be received on both metal and wood poles. I. J. Bryan is clerk.

ROCKFORD, ILL.—A deal is being negotiated between the owners of the Rockford & Interurban Company and an eastern syndicate, and it has been announced that the Rockford Street Railway Company and the street lines of interurban service controlled by it will pass into the hands of a company now organized and securing the plants of other systems in this vicinity.

EAST ST. LOUIS, ILL.—At a recent meeting of the East St. Louis City Council the St. Claire Light & Power Company, of East St. Louis, asked for an extension of its franchise from one year to eighteen months. The company was granted a franchise last May to erect a plant and to furnish electric current for light and power, but up to the present time it is stated nothing has been done by the company.

WALKERTON, IND.—An electric light plant, to cost about $5,000, will be erected here.

RICHMOND, IND.—The City Council is about to ask for bids for the construction of a 48-duct conduit system in Main Street; probable cost, $40,000.

INDIANAPOLIS, IND.—The Central Union Telephone Company is contemplating the erection of an eight-story building in this city for its general and local offices.

LOGANSPORT, IND.—The Indiana Rapid Transit Company has made application to the board of public works for a franchise to enter the city. The company proposes to build an interurban railway from Terre Haute to Logansport via Crawfordsville and Frankfort.

EVANSVILLE, IND.—The Evansville Gas and Electric Light Company, the Evansville Electric Railway Company and the traction lines from this city to Princeton, Boonville, Rockport and Mt. Vernon will be consolidated under one management and a traction line built from this city to Indianapolis.

EVANSVILLE, IND.—A movement is on foot to establish another electric light plant in this city. A petition for a franchise has been filed with the board of public works asking for the right to furnish light and power to the people of Evansville. Morgan Babcock is the petitioner, and agrees to lay all service wires under ground in conduits, and give the city 5 per cent of the gross receipts each year.

MARLOW, I. T.—An electric light plant will be installed in connection with the water works system in this town.

CHICKASHA, I. T.—The electrical engineer of the new street railway line arrived in this city with complete plans and specifications of the eight miles of line to be built together with plans and specifications of the big power house to be erected in connection with the same.

OTTUMWA, IA.—The Ottumwa Railway & Light Company will erect a new power house.

BURLINGTON, IA.—The Iowa Telephone Company is preparing to erect a new exchange in this city.

MUSCATINE, IA.—An interurban railway will be constructed in this city to run between here and Iowa City.

BOONE, IA.—The Fort Dodge, Des Moines & Southern Railroad Company of this city, which is building the interurban line from Des Moines to Fort Dodge for the Newton & Northwestern Railroad Company, has filed amended articles of incorporation with the Secretary of State, increasing the capital stock to $1,000,000. The directors are Frederic A. Farrar, S. D. Loring, Homer Loring and Henry W. Poor. The company has let additional grading contracts for the line running from Lanyan to Fort Dodge, a distance of 21 miles.

CALDWELL, KAN.—The citizens of this town have voted to issue $15,000 bonds for the construction of an electric light plant.

ELDORADO, KAN.—The Eldorado Light Heat, Ice & Power Company has secured a franchise for a gas and electric light plant.

TOPEKA, KAN.—A new electric lighting and power plant is to be established in this city. C. R. Maunsell is reported to be interested in the enterprise.

BARTLESVILLE, KAN.—The Bartlesville Interurban Railway Company has completed arrangements for the construction of the interurban railway between this place and Dewey. It is estimated that the cost will be about $100,000.

TOPEKA, KAN.—The Missouri & Kansas Telephone Company has asked the Council for a new franchise. The company has commenced extensive improvements to its system, and will expend about $150,000 before the work is completed.

LOUISVILLE, KY.—The Board of Aldermen has adopted an underground wire ordinance.

COVINGTON, KY.—Owen Ford, St. Louis, Mo., is preparing plans for a municipal electric light plant here.

LOUISVILLE, KY.—The Board of Aldermen of the city of Louisville, Ky., has defeated the Atherton electric light franchise ordinance. The Louisville Lighting Company has on the other hand granted important concessions in prices.

EMINENCE, KY.—By order of court the Eminence Electric Light Company has been placed in the hands of a receiver, with instructions to begin the operation of the plant at once. Claims amounting to $50,000 have been lodged against the plant.

OLYMPIA SPRINGS, KY.—An electric lighting plant is to be installed in the new hotel, which has just been completed. The plant will be large enough to light the hotel, cottages and grounds of the resort. Smith, Watkins & Co. will install the plant.

LOUISVILLE, KY.—The Louisville Lighting Company has filed amendments to its charter, granting it permission to furnish hot water for heating purposes, and to establish a plant to furnish steam and electrical power in Louisville and elsewhere.

NEW ORLEANS, LA.—The Cumberland Telephone Company is remodeling and rebuilding its telephone system and is considering the purchase of a building in this city for its exchange.

THIBODAUX, LA.—The citizens are considering doubling the capacity of the municipal electric light and water works plant by installing a 100-kw, 125-volt machine with balancing set to replace the two 37½-kw, 125-volt machines, on the Edison three-wire system now in use. The lighting system also includes one Western Electric series arc machine of 60-light capacity. A. R. Staunton is city electrician.

BINGHAM, ME.—The Messalonskee Electric Company, of Waterville, Me., contemplates installing an electric lighting plant in this place soon.

CARIBOU, ME.—The Caribou Water, Light & Power Company has recently added a new generator and made other extensive improvements to its plant.

PORTLAND, ME.—The Maine Light, Heat & Power Company has been incorporated with a capital stock of $250,000. The incorporators are Philip J. Deering and others.

SOUTH PARIS, ME.—At a recent meeting of the village corporation held for the purpose of considering the question of a municipal electric light plant, it was decided not to construct a plant.

EASTPORT, ME.—A new boiler is now being installed in the electric lighting plant of the Eastport Electric Company. The company also contemplates making other improvements to its plant in the near future.

HYATTSVILLE, MD.—Bonds to the amount of $12,000 have been sold, to be used for the construction of an electric light plant.

BALTIMORE, MD.—The Maryland Telephone Company is contemplating installing the automatic system in its exchange in this city. D. E. Evans is president.

GREAT BARRINGTON, MASS.—The town has reduced the appropriation for street lights this year from $4,600 to $3,500.

SOUTH DARTMOUTH, MASS.—H. K. Wilson, of New Bedford, writes that the question of constructing an electric light plant at South Dartmouth has been abandoned.

NANTUCKET, MASS.—The Citizens' Gas, Electric & Power Company will soon install another gas engine, made by the Westinghouse Machine Company. R. W. Coleman is superintendent.

HOLYOKE, MASS.—The power plant of the Holyoke Water Power Company is now completed and will soon commence operation. It is expected to be able to supply its customers by May 1.

HUDSON, MASS.—The municipal electric light board has made an announcement that there will be a reduction in the price of electricity after July 1. The board is not ready to state what the reduction will be.

FITCHBURG, MASS.—The Fitchburg & Leominster Street Railway Company contemplates making extensive additions to its power department, and is considering moving the power plant from South Fitchburg to Ayer.

PITTSFIELD, MASS.—It is reported that the Pittsfield Electric Company will increase its capital stock from $150,000 to $225,000. The company will soon erect a large power house and make extension additions to its plant.

WOBURN, MASS.—On recommendation of Mayor Linscott, a council committee, comprising James H. Connolly, chairman; Caleb H. Jaquith and G. William Buchanan, has been appointed to investigate the matter of a municipal lighting plant.

BROCKTON, MASS.—The city recently has made a contract with the Edison Illuminating Company for lighting the city hall and the central police station. The city hall lighting plant will not be operated after the contract takes effect.

BALDWINSVILLE, MASS.—A special town meeting will be called in May for the second vote on the matter of establishing a municipal electric lighting plant in this town. If the plant is voted for an appropriation will be made at the same meeting, and the plant will be installed this summer.

RUSSELL, MASS.—The power plant which is being constructed on the Westfield River in this place will soon be ready for operation. The company expects to generate from 500 to 700 hp and will supply the Western Massachusetts Street Railway Company with power, as soon as the plant is completed.

MILFORD, MASS.—The power house of the Norcross plant of the Milford Stone Company was recently destroyed by fire. The loss on the machinery and tools, which included two large boilers and engines, dynamo, lathes, etc., is estimated at $7,000. The plant will be rebuilt as soon as possible.

MIDDLETON, MASS.—At a recent meeting held by the town to hear the report of the electric light committee, the citizens voted not to build an electric light plant. The committee found that the town would have to appropriate about $10,000 for the plant, and consequently reported unfavorably on the matter.

HUDSON, MASS.—The trustees of the municipal electric light plant will soon commence work on the extension of its lines to Gleasondale for the purpose of furnishing light, heat and power to that village.

EAST BRIDGEWATER, MASS.—At a recent town meeting it was voted to appropriate $600 for electric lighting for the rest of the year. The Selectmen are instructed to make a contract with the Edison Company for the erection and maintenance of 69 lamps of 25 cp, each for a period of three years, at a cost of not more than $18 a lamp per year.

SALEM, MASS.—The street lighting committee has made a contract with the Salem Electric Lighting Company to light the city for five years at $95 per year per arc light and $22 per year for each incandescent light. The City Council also passed an order to make a contract with the electric light company to pump sewage by electricity at 1¼ cents per kw-hour.

MATTAPOISETT, MASS.—It is reported that this town will soon have an electric light service. Negotiations have been in progress for some time between the Selectmen of the town and the New Bedford Gas & Edison Light Company, and a number of interested summer residents. Things have so far progressed that little remains to be done except for the Selectmen to grant the electric company the right to certain pole locations in the town.

LOWELL, MASS.—Under a proposition made by Mayor Casey the contract for electric lighting which calls for $120.45 per lamp will probably be declared void and a new contract made at $100 per lamp. In consideration of this change the Lowell Electric Light Corporation is to receive the contract for lighting 400 lamps that are now lighted by gasoline. The gasoline lighting contract expires June 1. At present the city pays $27.75 per lamp for 400 lamps; under the proposition made by Mayor Casey, electricity will be substituted at a cost of $22.50. It is understood that the Lowell Electric Light Corporation will accept the mayor's proposition.

ELK RAPIDS, MICH.—The Village Council has granted a franchise for an electric lighting plant to A. P. Dougherty.

SAGINAW, MICH.—H. B. Slocum, of Hubbardstown, has been looking up the prospects for an electric railway from here to Grand Rapids.

PORT HURON, MICH.—Arrangements are now being made for the construction of the new power house for the Grand Trunk Railroad to be located on Military Street.

FLINT, MICH.—The Flint Light & Power Company has purchased the old Lewis flour mills, four miles west of the city, for $12,000, and will improve the property for power purposes.

GRAND RAPIDS, MICH.—The Edison Company has been awarded the contract for the furnishing of all the light and power required in the new furniture exposition building constructed by the Manufacturers Building Association.

FLINT, MICH.—R. O. Hart and H. R. Loranger have applied to the Council for a light and power franchise, and are contemplating the development of a power plant on the Flint River of 2,000 hp, which will cost about $100,000.

DANBY, MICH.—The Michigan Power Company has filed a petition with the county clerk of Ionia County asking permission to build a dam across Grand River on section 4 in this city, for the purpose of generating electricity for power and lighting purposes.

ROCKLAND, MICH.—The citizens residing in the vicinity of the Victoria mine are agitating the question of a lighting plant. The Victoria Company is about to install a dynamo for the purpose of generating power for its mine, and may furnish light for the village.

ONTONAGON, MICH.—The village has awarded a contract to the Lane & Bodley Company of Cincinnati, Ohio, for a new electric lighting plant. The equipment will consist of a 140-kw dynamo, 225-hp Corliss engine, switchboard and 16 arc lamps. The cost of plant is $8,165, including installation. The plant is to be ready for operation in 40 days.

ORION, MICH.—The Lake Orion Power & Improvement Company, which is successor to the Orion Light & Power Company, contemplates making extensive improvements to its plant. The company intends to put in a larger water wheel and generators and build a new power house, also to put in a 150-hp steam-driven unit as an auxiliary to the water wheel.

DETROIT, MICH.—The Detroit Railway Company is considering the construction of an extension of its line from Romeo to Almont, and possibly to Imlay City. It is reported that the company is negotiating for the purchase of the Pontiac, Oxford & Northern Railroad running from Pontiac to Caseville, a distance of 100 miles, and that if the purchase is made, the road will be equipped as with electricity.

GRAND RAPIDS, MICH.—The Muskegon Power Company has filed notice of an increase of capitalization from $1,000,000 to $3,000,000. The name of the company has also been changed from the Grand Rapids-Muskegon Water Power Electric Company to the Grand Rapids-Muskegon Power Company. The company has filed in Muskegon County a $7,500,000 twenty-five year trust mortgage issued to the First Trust and Savings Bank of Chicago as trustees. The mortgage covers all the property owned by the company and covers the expenditures that will be incurred in building the second dam. A similar mortgage deed was filed about six months ago when dam No. 1 was in process of completion.

WILLMAR, MINN.—The Willmar Telephone Exchange Company will make improvements to its exchange; estimated cost, $11,000.

MINNEAPOLIS, MINN.—The Mississippi River Power Company has been formed to generate electric power at dams to be built at Clear Water and Monticello. Geo. A. Moore, of St. Cloud, Minn., is interested.

DULUTH, MINN.—The Zenith Telephone Company contemplates extensive improvements and extensions to its system in this city. The wires will be put underground and cable substituted for overhead wires wherever practicable. The cost is estimated at $75,000.

PERRYVILLE, MO.—A company has been recently organized by several prominent business men of this place to build an electric railway from Perryville to Clearyville, on the Mississippi River. The officers are Dr. D. F. Morton, president; S. C. Marks, secretary; A. E. Doerr, treasurer.

ST. LOUIS, MO.—The Maplewood Improvement Association and Suburban Railway system have announced their intention to extend the road to Greenwood as soon as a franchise can be obtained from the county court. Julius S. Walsh is vice-president and general manager of the Maplewood Improvement Association.

LIVINGSTON, MONT.—The Livingston Water Power Company has received the contract for lighting the streets of the city.

HOLDREGE, NEB.—The City Council has granted a twenty-year franchise to the Huntley and Mill Creek Telephone Company.

CONCORD, N. H.—The contract has been awarded to the Hub Construction Company for the building of the Hudson, Litchfield & Toff Falls Electric Railway, and work on the road will commence at once.

SWANZEY, N. H.—At a recent annual meeting of the town of Swanzey, it was voted to appoint a committee to secure electric street lights for West Swanzey for a term of five years. The contract has been awarded to the Keene Gas & Electric Company, of Keene, N. H.

PORTSMOUTH, N. H.—Bids will be received until May 26 by Mordecai T. Endicott, Chief of Bureau, Yards and Docks, Navy Department, Washington, D. C., for furnishing two 8-inch motor-driven centrifugal pumps, at the Navy Yard, Portsmouth, as per specification No. 1,494. The estimated cost is $3,500.

LACONIA, N. H.—The Laconia Electric Light Company is to make extensive improvements in its power station within the next few months. The power house is to be enlarged so that it will accommodate three Deisel engines of 250 hp each. There is at present in the station one 250-hp Deisel engine in addition to the water power. A second engine has been ordered and will be installed as soon as it arrives, and important changes will be made in the plant.

RUTHERFORD, N. J.—The question of constructing a municipal electric light plant is under consideration. A. H. Brinkerhoff is mayor.

ATLANTIC CITY, N. J.—The City Council has passed an ordinance authorizing the issue of $30,000 bonds, for placing the city wires in conduits.

HIGHLANDS, N. J.—The McCay Engineering Company, of Baltimore, Md., has secured the contract for constructing water works and an electric light plant. T. H. Lane is borough clerk.

BRADLEY BEACH, N. J.—Borough Engineer Rogers has presented a preliminary report to the Council on the construction of a municipal water works and electric light plant, which he estimates at $63,000 for a combined plant.

GALLUP, N. M.—Maynard Gunsel has purchased the electric light plant and will improve the same.

SAVANNAH, N. Y.—The Syracuse, Rochester & Eastern Railroad has been granted a franchise by the Board of Trustees.

NEW YORK, N. Y.—The New York Edison Company contemplates erecting a two-story brick power house, which will cost $60,000.

YONKERS, N. Y.—The Mayor has signed the ordinance providing for the issue of bonds to construct a municipal electric light plant.

GENEVA, N. Y.—At a recent meeting of the Council a committee was appointed to investigate the cost and advisability of constructing a municipal electric light plant.

LOCKPORT, N. Y.—The Lockport Gas & Electric Light Company is now stringing wires for the installation of its new lighting system of double-enclosed arc lamps.

FT. WOOD, N. Y.—Bids will be received by Captain G. C. Burnell, Constructing Quartermaster, U. S. A., until June 1 for constructing an electric light and power system at this post.

BUFFALO, N. Y.—The grant to the International Railway Company for the right of way to lay a crosstown line in Fillmore Avenue will result in the expenditure of about $1,500,000.

NORTH TONAWANDA, N. Y.—Work has commenced on the building for the telephone exchange for the Niagara County Home Telephone Company on Oliver Street. It will cost about $6,000.

WHITESBORO, N. Y.—The Utica Gas & Electric Company will soon make an application to the Board of Trustees here for a franchise to lay its conduits and open mains on certain streets in the village.

COLONIE, N. Y.—The Schenectady Illuminating Company has secured the contract for lighting this village, and preparations are now being made for equipping the village and vicinity with electric lamps.

NEW YORK, N. Y.—The Atlantic Telephone Company has appealed to the Board of Estimate and Apportionment for a speedy decision on its application for a franchise to operate a telephone system in the city of New York.

BINGHAMTON, N. Y.—A strong sentiment is developing among the citizens and the Board of Aldermen in this city for the construction of a municipal electric lighting plant, to be run in connection with the city pumping station.

TROY, N. Y.—The city of Troy is contemplating establishing a municipal electric light plant. The bids submitted by the two electric light companies were considered exorbitant, and the council immediately set to work for plans for a plant of its own.

LIMA, N. Y.—The Lima & Honeoye Electric Light & Railroad Company contemplate the extension of its line to Rochester on the north, a distance of eleven miles, and to the lakes, a distance of eleven miles on the south. E. D. Watkins is manager.

SANFORD, N. C.—The town of Sanford has under consideration the purchase of the local electric lighting plant, owned by H. I. Thompson.

LEXINGTON, N. C.—The town commissioners have granted the Southbound Railway Company a franchise to operate a street railway system in and around the city.

BREVARD, N. C.—The Brevard Light & Power Company will develop a water plant on the Little River to take the place of its steam plant. J. W. Chapman is manager.

WILMINGTON, N. C.—It is reported that the Consolidated Street Railway Company is endeavoring to secure control of an extensive dummy freight line in this city and operate same by electricity.

CLINTON, N. C.—Franchises and other inducements are offered for private ownership, also plans and estimates are wanted for municipal ownership of water works and electric light plant for the town of Clinton. Address R. H. Hubbard, Mayor.

CONCORD, N. C.—The Cannon Company, one of he largest cotton mill concerns in the South, with offices at Concord, is reported to have decided to use electrical power from the Whitney Company's plant under construction on the Yadkin River.

GOLDSBORO, N. C.—At a recent town meeting W. J. Matthews was appointed to visit several municipal plants to secure information concerning the operation of electric light and water plants. The citizens are contemplating installing a municipal plant.

RALEIGH, N. C.—The Electric Bond & Share Company of New York, of which Marsden J. Perry of Providence, R. I., is president, has purchased a controlling interest in the Raleigh Electric Company, operating the city railway and light plant here. Mr. Perry and his associates are lessees of the Atlantic & North Carolina Railway and own the Norfolk & Southern and other railroads in Eastern North Carolina.

GARRISON, N. D.—A survey will be made at once, with a view to constructing a water works and an electric light plant.

TOLEDO, OHIO.—The Toledo Gas, Electric & Heating Company is preparing to make extensive improvements to its plant.

YOUNGSTOWN, OHIO.—The Mahoning & Shenango Valley interests are contemplating the extension of its line from New Castle to West Pittsburg.

WADSWORTH, OHIO.—The Northern Ohio Traction & Light Company has applied for a franchise in Wadsworth for its new extension from Barberton to this place.

FINDLAY, OHIO.—Engineers have begun the survey of the proposed Findlay-Marion electric line at Mt. Blanchard, and work will be pushed from Mt. Blanchard to this city.

CLEVELAND, OHIO.—The Cleveland Electric Railway Company contemplates extending its Euclid Heights line for a distance of about three miles to Center Road in Warrensville.

GIRARD, OHIO.—C. F. Brotherton, of Ashtabula, O., has secured a franchise for an electric lighting and a water works system and will erect a plant to take care of both lines of business.

MORROW, OHIO.—The survey has been completed and the plans and specifications are now in the hands of the contractors for the construction of an electric railway from South Lebanon to Morrow.

BELLEFONTAINE, OHIO.—The Board of Public Service is installing American Diesel engines and making other improvements in the city electric light plant. M. D. Ehrhart is city electrician.

DAYTON, OHIO.—The Dayton & Northern Traction Company is preparing to make a number of improvements to its line. A storage battery substation is being built at Haines Station, six miles from Dayton.

LIMA, OHIO.—It is stated that the Lima & Eastern Railway has secured practically all the right of way from Lima to Marion, and that work on the road will start early in May. W. H. Wyke is general manager.

SHILOH, OHIO.—Citizens of this place have secured a right of way from Shiloh to Shelby, which they are offering to the Shelby-Mansfield Company to induce it to extend to that town. The matter is under consideration.

BOWLING GREEN, OHIO.—A franchise has been granted to the Lake Erie, Bowling Green & Napoleon Railway Company for its proposed extension westward from this place. The line eventually will be extended to Napoleon.

PORTSMOUTH, OHIO.—The Portsmouth Street Railway & Light Company has increased its capital stock from $125,000 to $500,000. The company has recently made improvements to its power station and equipment and is planning extensions.

CLEVELAND, OHIO.—The Cleveland & Southwestern Traction Company has under consideration a large number of improvements which will be made within the next year, including the purchase of additional boilers for the main power stations.

AKRON, OHIO.—The Northern Ohio Traction & Light Company has placed a contract with the Cleveland Construction Company for the immediate construction of the extension of its road from Barberton to Wadsworth, a distance of six miles.

DAYTON, OHIO.—The Dayton Citizens' Electric Company has accepted the franchise granting the right to install a system in Dayton which was passed some time ago. A bond for $100,000 has been deposited with the city for the faithful performance of the contract.

SPRINGFIELD, OHIO.—The Washington Traction Company has secured all the right of way for extending the line from Charleston to Washington, C. H., and will let contracts at once. The company is planning to build a power station and repair shop at Washington, C. H. E. W. Christy is president.

DELAWARE, OHIO.—The Richmond & Magnetic Springs Railway Company has purchased the right of way for its line between Delaware Magnetic Springs and Richwood, and is planning to begin the construction. Christopher Magee, Jr., of Pittsburg, is president, and H. E. Buck, of Delaware, is general manager.

CLEVELAND, OHIO.—Bids will be received until May 4 by the Board Public Service for an engine of at least 750 hp, and an alternating-current generator of at least 500 kw capacity, and appurtenances, including switchboard, for the enlargement of the municipal electric light plant. A. R. Callow is secretary.

TIFFIN, OHIO.—The Farmers' Mutual Telephone Companies, of Seneca County, has closed a contract with the Tiffin Home Telephone Company, to connect its lines with its exchanges. It will be afforded long-distance service through the lines of the United States Telephone Company. About 3,000 farmer's homes will be connected.

CLEVELAND, OHIO.—The Lake Erie Terminal & Southern Railway Company states that a contract has been placed with the Terminal Construction Company, of Cleveland, for building the line from Independence to Akron, a distance of 30 miles. This is part of the line that the company proposes to build from Cleveland to Akron.

DEFIANCE, OHIO.—E. C. Bell, of Cincinnati, and Dr. D. A. Rigrish, of Defiance, are promoting an electric railway from Defiance to Bryan and Montpelier. This project is believed to be for an extension of the Columbus & Lake Michigan Railway, a steam road which was recently acquired by the Schoepf syndicate and which is to be converted to an electric line.

COLUMBUS, OHIO.—The Newark Telephone Company has announced that steps will be taken at once to provide for 1,000 new main line telephones. About 45,000 ft. of new cable, or nine miles, will be laid. Over 9,000 feet of new cable will be under ground. The improvements will be made from the proceeds of the new preferred stock, the majority of which was sold in Columbus.

CLEVELAND, OHIO.—J. W. Holcomb and C. F. Morley, chief promoters of the Cleveland, Ravenna & Alliance Railway, state that they have secured nearly all the right of way between Alliance and Clevland city limits. The promoters are also considering the question of building a spur line from Hudson to Warren, which will give to the company an excellent route from Cleveland to Youngstown.

STEUBENVILLE, OHIO.—The Wellsburg, Bethany & Washington Street Railway Co., recently formed to build a line from Wellsburg to Bethany and Washington, W. Va., has secured the right of way for its line. The company has purchased a coal mine near Underwood, and a power station will be erected so that coal will run direct from the mine to the power station. A. Cramblett is president.

NEWKIRK, OKLA.—Thomas Smith, of Newkirk, who is at the head of a company promoting a project for the construction of an interurban electric railway to extend from a point in Kansas southward to Oklahoma City, has secured the right of way through Kay, Noble and Logan Counties.

RAINIER, ORE.—The plant of the Rainier Electric Light & Power Company is completed and in operation. The company has but one street lamp in operation at the present time, but more will be put up immediately. The majority of business houses are now using electric lamps.

PINE CREEK, ORE.—The California & Oregon Light, Heat & Power Company is contemplating the installation of a new and larger power plant, for the purpose of furnishing light and power to the towns of Surprise Valley and Goose Lake Valley. The company expects to spend about $20,000 in improvements.

COTTAGE GROVE, ORE.—The Willamette Valley Electric Company has asked the City Council for an extension of its franchise for the electric light plant from 12 to 30 years. The Council deferred the matter for final action until May 7. The company has recently acquired this plant, and is making preparations for the installation of a large plant. It is reported that the company is preparing to put in a larger system of electric roads. The improvements under way will cost about $10,000.

NEWCASTLE, PA.—The Citizens' Telephone Company is preparing to place its wires in conduits.

MT. HOLLY, PA.—The Carlisle & Mt. Holly Electric Railway will be extended this summer from Mt. Holly to Gettysburg.

NEW CASTLE, PA.—The New Castle Electric Street Railway Company contemplates the extension of its lines from this city to West Pittsburg.

MORTON, PA.—The Philadelphia Suburban Electric Light Company has purchased the plant of the Faraday Heat, Light & Power Company in this city.

WASHINGTON, PA.—The Washington Electric Light & Power Company has secured the contract for lighting the town for five years, at $70 per lamp per year.

DOYLESTOWN, PA.—The Bucks County & Willow Grove Transit Company will commence work May 1, on the construction of the electric street railway from this place to Perkasie.

SHIPPENSBURG, PA.—Bids will be received until June 7 by the president of the Town Council for lighting the streets of the Borough for one year from October 1, 1906. S. A. Angle is chairman of the light committee.

DANVILLE, PA.—The Trustees of Danville Hospital for Insane have awarded Buchanan & Company, of Philadelphia, the contract for the power house, electric generator plant, engine, boilers, etc., and for the necessary wiring for $73,702.

ERIE, PA.—It is reported that the Bell Telephone Company contemplates making some improvements in the local system in the near future.

It is now rushing the work on the new lines and system, made necessary by a large increase of business.

OIL CITY, PA.—The boiler and power houses of the Citizens' Traction Company and Oil City Light & Power Company at West End were destroyed by fire last week. The city was temporarily in darkness, and Franklin, Rouseville, Reno and suburbs, as well as Oil City, were without street car service. The loss is estimated at $250,000 to $300,000.

PHILADELPHIA, PA.—James N. Vandergrift, of Syracuse, N. Y., has been commissioned to prepare plans for the proposed electric railway tunnel under the Delaware River, which will connect Camden, N. J., and Philadelphia, Pa. The work calls for 2,700 ft. of tunnel under the river and a mile of subway approaches. The promoters of this undertaking are the Wolf Brothers, of Philadelphia and New York. Plans for the construction, it is said, will be ready by September.

READING, PA.—The Nolde & Horst Company has recently placed a contract with the Brown Engineering Company, of this city, for a complete power plant. The contract includes a 375-hp Fitchburg high speed engine, a 300-hp General Electric generator, together with switchboard, 40 General Electric motors and other machinery. Each department will be individually driven by the electric motors, doing away with belts, line-shafting, hangers, etc. Sixteen departments will be driven by Morse silent chain drives in connection with electric motors.

YORK, PA.—The York Haven Water & Power Company has awarded to Spahr Bros. a contract for the erection of a sub-station at Harrisburg for the transmission of current from the York Haven plant to the capital city. Work on the station will begin at once and the equipment will be installed immediately after the erection of the building so that Harrisburg will be supplied with electric current from the York Haven plant this summer. Current from the big hydro-electric plant near the falls of the Susquehanna is now being supplied to Middletown, Steelton and this city. Other towns will be added to the company's lighting and power system within the next year and additional machinery increasing the capacity of the plant will be installed at York Haven.

CHARLESTON, S. C.—A contract has been signed with the Consolidated Electric Company of Charleston, to supply electric lights to Sullivan's Island, which will be made a principal resort place this summer.

GREENWOOD, S. C.—The commissioners of public works of Greenwood have made a contract with the Savannah River Power Company to furnish the town of Greenwood with an unlimited amount of electric power for a period of ten years with an option for ten years more at the same price. The city of Greenwood still owns a first-class electric light plant, and this will be maintained in its present high state of efficiency to be used in case of an emergency. The price of current obtained from the power company will be much cheaper than it is possible to furnish it here, owing to the high price of fuel. The power company's plant will not be completed for several months, and pending this the plant here will operate a day current by steam from May 15.

LAFOLLETTE, TENN.—The power plant of the Lafollette Water & Light Company is nearly completed and will be ready to light the city in June. The company is also installing a modern telephone plant, which will be in operation in May.

JACKSON, TENN.—A Louisville syndicate composed of Attilla Cox, John L. Helm, George Gaulbert, J. W. Gaulbert, William Jarvis, Henning Chambers, Oscar Fenley, C. E. Claggett, Harry Weissinger and S. S. Bush, has purchased the electric railway and lighting properties at Jackson, Tenn. The new company will be called the Jackson Electric Company, and will make immediate improvements and extensions to the system. The company will abandon the present power plant and rebuild an up-to-date plant at a new location, and will give particular attention to lighting and power. The company will add at once 7 miles of track to the 3½ miles acquired, and will build a suburban line to Bemis, a distance of three miles. S. S. Bush, general manager of the Pascagoula Street Railway & Power Company, of Scranton, Miss., is also general manager of the Jackson Electric Company, and will build and manage it, with his general office for both companies at Louisville, Ky. The same syndicate owns both properties.

STRAWN, TEX.—Eugene Moore is interested in the construction of an electric light plant at Strawn.

GAINESVILLE, TEX.—The Southwestern Telegraph & Telephone Company is making plans to put its wires underground in the business portion of the city.

MARSHALL, TEX.—The Arkansas & Texas Consolidated Ice & Coal Company contemplates changing the frequency of its circuits from 125 to 60 cycles this fall, and also contemplates changing the primary voltage to 2,000, and establish a power circuit with 24-hour service.

TEMPLE, TEX.—It is learned that the improvements contemplated by the Southwestern Telephone & Telegraph Company contemplate practically rebuilding the entire plant at a cost close to $50,000, instead of $20,000, as at first reported. The system will be entirely changed, a new central office established, and extensive cabling will be done.

PARK CITY, UTAH.—The Summit Electric Company, which was given a franchise some time ago, will begin work at once on the installation of its new plant. This company is part of the Utah Electric Company, and it will furnish power to the local company from its plant at Cottonwood Canyon. According to the contract the Summit Electric Company is to have light in the city hall on or before July 1.

SALT LAKE, UTAH.—The Bingham Metal Mining Company has made application at the State Engineer's office for an appropriation of water to be used for power purposes. The plant is to be built near Tooele City and the water diverted from the near-by canyon. A rock-crib dam is to be built and a pipe laid a distance of 5,570 feet. One eighteen-inch impulse wheel operating under a head of 700 feet will be installed.

RICHMOND, VA.—The Citizens' Rapid Transit Company of Richmond, which has been organized for several years with the purpose of building a street railway system in Richmond, has applied for a change of charter increasing the capital from $500,000 to $1,000,000.

RICHMOND, VA.—It is stated that the Southern Bell Company is contemplating the construction of a new building and putting its wires underground. Work will commence on the new building in May. The cost of the building and other improvements will be about $250,000.

CHRISTIANSBURG, VA.—The sub-station of the Grayson Electric Company was destroyed by fire April 18. The building was erected and equipped last January at a cost of $25,000. The town will be without electric light until a new station can be built and equipped, which will be a month or more.

SUNNYSIDE, WASH.—Prof. O. L. Waller, of Pullman, has secured a franchise for water works and an electric light plant.

SEATTLE, WASH.—The City Council has passed an ordinance directing the city comptroller to advertise for sale $600,000 lighting bonds.

BREMERTON, WASH.—Paul Mehner, city clerk, writes that there is some talk of constructing a municipal electric light plant, but nothing definite has yet been done. S. H. Berry is city engineer.

SEATTLE, WASH.—R. H. Thomson, city engineer, is preparing the plans and estimates for a city street railway system, covering the whole city of Seattle, and the proposal to construct the system will be submitted by the City Council to a vote of the people without delay.

SPOKANE, WASH.—The Spokane-Pend d'Oreille Rapid Transit Company, of Spokane, is rapidly arranging the preliminaries preparatory to constructing its proposed line, which will be operated on the single-phase system, and will be 30 miles in length. The company has made arrangements to purchase 1,000 hp from the Washington Water Company, to be taken from its new power station at Post Falls, Idaho, to be delivered at Rathdrum. C. H. Reeves is president.

SPOKANE, WASH.—The property, franchises, rights and interests of the Centralia-Chehalis Electric Railway & Power Company have been acquired by C. H. Weeks, Cyrus Bradley and Benjamin J. Weeks, of Spokane, and W. W. Cannon, of Centralia. The company owns a water power on the Chehalis River, and it is planned to construct a power plant there to furnish power for its lines, but power for the Centralia-Chehalis link, which is the first to be constructed, will be furnished from a smaller plant to be established at Centralia at an early date.

SOUTH BEND, WASH.—The Raymond-South Bend Electric Company, which has been recently incorporated, will soon construct an electric light plant to furnish electric lights for Raymond and South Bend, and will also construct and operate an electric railway between the two places. It is stated that a power house is to be erected at the Siler switch junction, for which the machinery has already been ordered, which includes two 200-kw dynamos, two 125-hp engines and three boilers. W. S. Cram, of Raymond, and M. C. Welsh, of South Bend, are among the incorporators.

BLACK RIVER FALLS, WIS.—E. E. Moore and Ray Gilfillan are interested in the construction of an electric power plant on Hall Creek.

RACINE, WIS.—The Milwaukee Light, Heat & Traction Company has purchased a site for a new power house. The company contemplates increasing its power and other improvements, involving an expenditure of about $50,000.

FERGUSON, B. C.—The Lardeau Light & Power Company contemplates increasing the capacity of its plant and extending the transmission line to Trout Lake City, a distance of four miles.

GRAND FORKS, B. C.—The West Kootenay Power & Light Company has changed its name to the British Columbia Construction & Distributing Company, Ltd. It is stated that the company does not contemplate making a deal with the Cascade Power & Light Company, but will continue to construct its line as far west as Boundary Falls, which is the western limit of its 50-mile charter.

STRATHCONA, CAN.—The citizens of this town have voted to appropriate $35,000 to construct a new municipal lighting plant. Address Will Godson.

OWEN SOUND, ONT.—The citizens of Owen Sound have voted to issue $45,000 to enlarge the electric light plant.

TORONTO, ONT.—The shareholders of the Toronto Street Railway have authorized the issue of $1,000,000 on new shares to provide for new equipment, extension of lines and other improvements, to be made at once.

ST. CATHERINES, ONT.—The contracts for the extension of the Niagara, St. Catherines & Toronto Electric Railway have been awarded to Joseph Battle, of Thorold, Ont., by President Fred Nichols. The proposed extension is from Thorold to Welland and Forthill.

WESTMOUNT, QUE.—The municipal electric lighting plant is nearly completed and will soon be in operation. The plant will furnish light to houses in the municipality in June, but will not furnish any street lamps until December. The plant when finished will cost about $194,000.

## Company Elections.

FALL RIVER, MASS.—At the annual meeting of the Automatic Telephone Company held recently, the following board of officers was elected: Clerk and treasurer, Bradford D. Davol; directors, Edward B. Jennings, Edmund W. Wakelee, John T. Swift, P. A. Mathewson, Joseph Watters, Martin Feeney and Brandford D. Davol.

COLUMBUS, MISS.—At the annual meeting of stockholders of the Columbus Light & Power Company, the following directors were elected for the ensuing year: Walter Weaver, W. H. Lee, C. F. Sherrod, C. A. Johnston and R. T. Williams. The directors held a meeting and elected the following officers for the above mentioned period: Walter Weaver, president; W. H. Lee, vice-president; C. F. Sherrod, secretary.

CANAAN, CONN.—At a recent meeting of directors of the Berkshire Power Company, held in Hartford, the following officers were chosen: President, J. Henry Roraback, of Canaan; vice-president, M. R. C. Corson, of Hartford; treasurer, Francis R. Cooley, of Hartford; secretary, Henry Lyles, of Canaan. Mr. Lyles will also continue as general manager of the plant.

## New Incorporations.

LITTLE ROCK, ARK.—The Pan Long-Distance Telephone Company, of Fort Smith, has been chartered with a capital stock of $1,000,000. The company proposes to build a long-distance telephone system over Arkansas and other States in this section.

TELLURIDE, COL.—The Institute Electric Company has been incorporated with a capital stock of $1,000,000, by Charles S. Ruffner, A. L. Woodhouse and others.

DENVER, COL.—The Denver Northern Railway Company has been incorporated with a capital stock of $3,000,000. The enterprise is said to be backed by W. C. Brown, vice-president of the New York Central lines, and others. Robert Law, of Denver, will be president and Captain Charles P. Brown, of Ottumwa, Ia., secretary and treasurer.

LAMAR, MO.—The Missouri Exchange Telephone Company has been incorporated with a capital stock of $10,000. The incorporators are B. M. Guinney, S. F. Snodgry, Maybelle Guinney and others.

SPRINGFIELD, MO.—The Springfield Home Telephone Company has been incorporated with a capital stock of $2,000. The incorporators are W. B. Scruggs, R. W. Adams, J. L. White, L. L. Clemments and others.

ST. LOUIS, MO.—Application for articles of incorporation have been filed by the Independent Electric Company, with a capital stock of $10,000. The incorporators are John Dowd, George J. Clark and E. F. Cunningham.

ANACONDA, MONT.—The Belt Valley Telephone Company has filed articles of incorporation with a capital stock of $25,000. The incorporators are C. E. K. Vidal and others.

LINCOLN, NEB.—The Smithfield Mutual Telephone Company has been incorporated with a capital stock of $3,000. The incorporators are C. A. Powell and others.

NEW YORK, N. Y.—The House Hill Telephone Company has been incorporated with a capital stock of $2,500, by Frank Ellison and others.

MANGUM, OKLA.—The Mangum Telephone Company has been incorporated with a capital of $100,000. The incorporators are A. Gordon and others.

NEWKIRK, OKLA.—The Newkirk Commercial Mutual Telephone Company has filed articles of incorporation with a capital stock of $12,000. The incorporators are C. A. Johnson and others.

OKLAHOMA CITY, OKLA.—The Oklahoma City & Shawnee Traction Company has been incorporated with a capital stock of $1,200,000. The incorporators are Douglas Crane and others.

CLEVELAND, OHIO.—The Northern Light Company has been incorporated with a capital stock of $10,000, by E. M. Cloves, R. S. McConnell and Samuel H. Kleinman.

JEFFERSONVILLE, OHIO.—The Jeffersonville Home Telephone Company has been incorporated with a capital stock of $10,000. The incorporators are Jacob Eberts and others.

BIRMINGHAM, OHIO.—The Riverside Telephone Company, of Birmingham, has been formed with $10,000 capital stock by S. Shissler, J. W. Ross, W. H. Funk, Z. C. Heald and G. W. Baker.

SCIO, OHIO.—The Doe Run Telephone Company, of Scio, has been formed with $10,000 capital stock by A. N. McCombs, W. H. Henderson, W. N. Henderson, F. S. Edger and W. B. Turner.

FLUSHING, OHIO.—The Stillwater Mutual Telephone Company of Flushing has been formed by A. J. Murphy, F. A. Groves, J. C. Groves, H. W. Howell and A. W. Collins. The capital stock is $10,000.

ELYRIA, OHIO.—The new local street railway company, which is under process of formation, will be incorporated, with a capital stock of $300,000. The promoters are A. L. Garford, J. C. Crist, T. M. Brush, E. T. Allen, J. C. Hill, E. W. Williams, R. W. Hill, Henry Ingersoll, S. B. Rawson and W. G. Sharp.

COLUMBUS, OHIO.—The Cleveland, Ashland & Mansfield Railway Company has been incorporated with a capital stock of $500,000. The incorporators are G. A. Bartholmew, T. C. Latham, A. N. Stentz, E. G. Avery and W. H. Kees.

EAST TOWNSEND, OHIO.—The Townsend Telephone Company has been incorporated by C. L. Moore, C. B. Canfield, G. N. Helling, A. D. Bargus and G. E. Stacey, with a capital stock of $10,000. The company will build a telephone exchange at East Townsend. It will have connection with the Norwalk exchange.

ARNOLD, PA.—The Arnold Light & Power Company has been incorporated with a capital stock of $5,000.

ASPINWALL, PA.—The Aspinwall Light & Power Company has been incorporated with a capital stock of $5,000.

CHESWICK, PA.—The Cheswick Light & Power Company has filed articles of incorporation with a capital stock of $5,000.

ERIE, PA.—The Northeast Heat & Lighting Company has been incorporated with a capital stock of $24,000. The incorporators are John Inglis and others.

ALBION, PA.—The Albion Light & Power Company has filed articles of incorporation with a capital stock of $5,000. The directors are R. P. Flower and others.

SHARON, PA.—The New Castle Telephone & Electric Company has been organized, with a capital of $200,000, and the following officers, William M. White, president, W. T. Herrington, secretary, and J. E. Duff, treasurer.

CHAMBERSBURG, PA.—The Chambersburg, Greencastle & Waynesboro Electric Street Railway has been incorporated with a capital of $500,000. The incorporators are Dr. R. W. Ramey and others. The company will build a street railway line from Greencastle to Foltz by way of the turnpike through Mercersburg.

SUMTER, S. C.—The Sumter Power, Light & Water Company has been incorporated with a capital of $80,000. The incorporators are Marion Moise, of Sumter, and G. E. Ladshaw and F. T. Bryant, of Spartanburg.

SOMERVILLE, TEX.—The Somerville Light & Manufacturing Company has been incorporated with a capital stock of $10,000. The incorporators are J. W. Landerdale and others.

HUBBARD, TEX.—The Union Central Light & Ice Company has been incorporated with a capital of $35,000. W. Aug. Bass is president, Allen & Scott, Waco, are the architects and engineers.

YORKVILLE, TENN.—The Yorkville Telephone Company has been chartered with a capital of $5,000. The company already has about 50 miles of lines connecting a number of towns in the vicinity.

JOHNSON CITY, TENN.—The Thompson Power Company has been incorporated, with a capital of $30,000 by T. M. Thorne, Robt. Martin and others, to improve and develop the water power of several East Tennessee streams.

RYEGATE, VT.—The Ryegate Light & Power Company has filed articles of incorporation with the Secretary of State, with a capital stock of $25,000. The company proposes to furnish light and power in the towns of Ryegate, Newbury and Groton. The incorporators are M. F. Sargent, F. J. Tewksbury, R. Farquharson, A. D. Grant, George H. Roben, Alexander F. Beaton, James Craigie, Charles H. Taplin and H. W. Goodine, of Ryegate.

SEDIO-WOOLLEY, WASH.—The Skagit Independent Telephone Company has been organized with a capital stock of $20,000.

SPOKANE, WASH.—The Empire Electric Company has been incorporated with a capital stock of $25,000. The incorporators are A. C. Rice and others.

BEAVER, WIS.—The Unity Telephone Company has been incorporated with a capital stock of $650 by George Stone and others.

## New Industrial Companies.

THE NOVELAND COMPANY, of Bridgeport, Conn., has filed articles of incorporation with a capital stock of $30,000. The incorporators are William F. Schweiger and Alfred Warren. The company will manufacture electrical apparatus.

THE VULCAN ELECTRIC HEATING COMPANY, of Chicago, Ill., has filed articles of incorporation with a capital stock of $50,000, for the purpose of manufacturing electrical appliances. The incorporators are L. P. Brown, Frank C. Holmes and Granville M. Cox.

THE CONSOLIDATED STREET LIGHTING COMPANY, of Portland, Me., has filed articles of incorporation with a capital stock of $1,000,000. The company proposes to manufacture and deal in all kinds of appliances for lighting purposes. The officers are Harry C. Weber, president, and Harry L. Cram, of Portland.

THE SANDWICH POLE CHANGER COMPANY, of Sandwich, Ill., has been incorporated with a capital stock of $5,000, to manufacture electrical apparatus. The incorporators are S. P. Sedgwick and E. C. Hennis.

THE LITCHFIELD ELECTRICAL SUPPLY COMPANY, of Litchfield, Conn., has filed a certificate of incorporation with the Secretary of State, with a capital stock of $25,000. The incorporators are Edwin B. Peck, Theron J. Loveland and Thomas P. Conroy.

## Legal.

STREET CARS PERSONAL PROPERTY.—The supreme court of North Carolina has decided that the street cars are personal property and not real property. The decision grows out of an appeal in The State vs. Martin, in which the defendant had been convicted of throwing a stone into a car at Winston-Salem, N. C.

THE ST. LOUIS LIGHTING MERGER.—A decision has been handed down by the United States Circuit Court of Appeals in the case of the Missouri Edison Electric Company. The case hinges on a $10,000,000 merger of the light and power companies of St. Louis, and granting the statements of the plaintiff, an attempt had been made to freeze out certain minority stockholders. This decision reverses that of the lower court and is regarded as admitting the legality of the merger under the laws of Missouri.

WATER POWER DISPUTE.—The Grand Ledge Electric Power Company has begun suit in the circuit court asking that the Michigan Power Company be enjoined from erecting and maintaining any dam across Grand River which would cause the water to overflow the lands owned by the complainant company, or which will interfere with the value of the water privileges owned by the Grand Ledge Electric Power Company, of Grand Ledge. Among other things, the complainant sets forth that the Michigan Power Company is conducting its operations in Eagle township without any expectation of building a dam without trespassing on the rights acquired by the complainant company. It is claimed further that the defendant's purpose is to hinder the Grand Ledge Company from carrying out its plans and compel a sale of such rights to the Michigan Power Company.

NEW YORK FRANCHISES.—At Albany on April 24 the Court of Appeals sustained the constitutionality of the law passed by the last Legislature taking from the Board of Aldermen in New York City the power to grant public franchises and conferring it upon the Board of Estimate and Apportionment. The decision was given in the cases of Clermont H. Wilcox, appellant, vs. George B. McClellan, as Mayor of New York, and others, constituting the New York City Board of Estimate and Apportionment, and Franklin Pettit, appellant, vs. the same. The appellants' first case was from a judgement of the Appellate Division, First Department, which unanimously affirmed a judgment entered upon a decision made by Justice James A. Blanchard, at Special Term, sustaining a demurrer to the complaint interposed by the defendants on the ground that the complain did not state facts sufficient to constitute a cause of action. The action was brought by the plaintiff as a taxpayer to prevent the defendants from granting certain franchises for underground railways in New York for the reason that the defendants had no right under the Constitution to grant such franchises, notwithstanding that the Legislature has conferred on the defendants the right to do the thing against which the plaintiff protested.

## Obituary.

MR. ROBERT J. SHEEHY, a well-known inventor of electrical appliances of various kinds, died in New York, April 26, after a surgical operation for cancer. He was born in Ireland and was 64 years of age at the time of his death. The body was cremated.

MR. HENRY E. HAWLEY.—It is with great regret that we note the sudden death of Mr. Henry E. Hawley, general manager of the Hudson River Telephone Company at Albany on April 27. He had suffered for some time with heart trouble and about two weeks ago he returned from a trip taken for the benefit of his health and appeared much improved. He was born in Troy, August 16, 1861. He was educated in the public schools of Troy and took a course at the Troy Business College. His first work was for the New York Central Railroad at Troy, where he filled a clerical position. After other business engagements, he became connected with the telephone company and was assistant to General Manager A. B. Uline, whom he succeeded January 1, 1892. Mr. Hawley married twice. His first wife was Miss Josephine Robinson, whom he married in 1883. His second wife, Miss Dora E. Uline, daughter of A. B. Uline, he married in 1888. He is survived by her and four children. There is one daughter by his first wife, and a daughter and two sons by his second. Mr. Hawley was a member of the Albany Club, the Troy Club and the Transportation Club of New York. He was also a member of the First Reformed Church. Mr. Hawley was prominent in Masonic circles.

## Educational.

BROOKLYN POLYTECHNIC INSTITUTE.—The Polytechnic Engineering Society held their first annual dinner at the Brevoort Hotel, New York, on Friday evening, April 20th. Many of the faculty, the alumni and the student body were present. Dr. Samuel Sheldon, as toastmaster, introduced Dr. Fred. W. Atkinson, who spoke on the "Future Policy." Dr. Atkinson stated in substance that it was the purpose of the trustees of the Polytechnic to concentrate their energies on the subjects of electrical, civil and mechanical engineering with a view to establishing in Brooklyn an engineering school of the highest type. Furthermore they proposed to limit the number of students in the day courses to 250, establishing an extensive waiting list. With this system they hoped only to graduate engineers of the highest standing and who could in time occupy positions of the greatest trust. They also proposed to continue the extension courses now given in the evenings so as to afford ambitious young men an opportunity to take advanced courses. Dr. Sheldon then introduced Dr. Nichols, president of the Board of Trustees, who corrobrated Dr. Atkinson's statements. The third speaker, Mr. Baker, editor of the *Engineering News*, spoke very enthusiastically upon "The Future of the Civil Engineer in the United States." Mr. T. D. Lockwood, of the American Bell Telephone Company, then spoke in his usual entertaining manner, upon the subject of "Electrical Articulation." Difficulties in the profession at the present time reside in getting to the top and also in staying at the top when near there. In other words, there is only room at the top for those who hustle. Mr. Bolton was the last speaker of the evening, expressing himself upon the subject of "The New York Central Terminal." Mr. Bolton strongly emphasized the fact that all modern facilities of life are based upon "pipes," telling of the water pipes, sewer pipes, electric conduits, ventilation, etc. The dinner terminated with cheers on the part of the student body for Mr. Sydney W. Ashe, who was responsible for the great success of the affair.

## Personal.

MR. P. G. GOSSLER, vice-president of J. G. White & Co., of New York, has reusmed work after an illness of nearly a month, due to a severe attack of grippe.

MR. V. R. LANSINGH delivered a lecture on Illuminating Engineering, illustrated by lantern slides, before the convention of the Western Gas Association, held in Chicago, on May 11.

MR. F. R. CORSON, superintendent of the Winnepiseogee Gas & Electric Company, of Laconia, N. H., has resigned to become superintendent of the St. Johnsbury, Vt., Gas Company.

MR. H. A. LARDNER, of the electrical engineering staff of J. G. White & Co., New York City, was dispatched last week to the Pacific Coast on a special mission in connection with electrical interests of the firm and its clients.

MR. W. H. ACKER, who has been with the Piedmont Electric Company, of Anderson, S. C., as local manager, has secured a position with the Westinghouse Company in Pittsburg, in the engineering department, assuming his new duties May 1.

MR. M. M. REID, of Springfield, Ohio, has been appointed superintendent of the municipal light plant at Columbus, Ohio. He was formerly chief engineer and master mechanic of the Appleyard system of traction lines centering at Columbus. He assumes charge, May 1.

MR. N. J. NEALL, consulting electrical engineer, has opened an office at 12 Pearl Street, Boston, Mass., where he will make a specialty of work in regard to lightning protective apparatus, in design, development and application; high tension alternating-current installations, and the rehabilitation of electrical plants of all kinds.

MR. OWEN M. BURGESS, of Nashville, Ill., has been appointed district manager of the Central Union Telephone Company, with headquarters at Centralia. His district embraces all of Illinois south of Decatur, and is the largest in the State. Mr. Burgess has been special agent for the company and was formerly connected with the Bell Telephone Company in St. Louis. He succeeds C. R. Stanhope.

MR. A. VENNING, an English consulting electrical engineer, has just returned to this country after an absence of over eight years, during which time he was connected with British Thomson-Houston central station interests and with London underground railway work. It is understood that he expects to stay permanently in the United States, where he has already had experience and has a wide circle of acquaintance.

NEW YORK ELECTRICAL SOCIETY.—The following named gentlemen were elected members of the New York Electrical Society at its meeting on April 25: Charles N. Green, New York; A. E. Mitchell, Baychester, N. Y.; Alex. Cameron, Brooklyn; Frederic A. Coolidge, Yonkers, N. Y.; Archer M. Huntington, New York; Leigh S. Keith, New York; Ainslie A. Gray, New York; Dr. Emil Heuel, New York; S. S. Dickinson, New York; C. B. Fairchild, Jr., New York.

GILMARTIN-HENDERSON.—On April 25, at the Church of the Holy Name, New York City, Miss Eva MacLeod Henderson, daughter of Mr. and Mrs. Alexander Henderson, was married to Mr. David Joseph Gilmartin, of the same city. The father of the bride is well known in electrical circles, and the large gathering at the church and home included a numerous and representative body from the electrical engineering and supply fields. The wedding was a very pretty affair and congratulations were showered upon the happy pair and upon the parents.

MR. H. A. REED, the veteran manufacturer, has resigned as treasurer of the Bishop Gutta Percha Co., and his oldest son, Mr. W. Boardman Reed, has been elected as his successor, while Mr. D. Reed has become vice-president. Mr. H. A. Reed has been with the enterprise 27 years and is to-day in his seventy-eighth year, hale and hearty, and will remain president. During the last three years he has seen the factory capacity increase 50 per cent, and he is now increasing it again in the shape of a new building 50 ft. by 100, five stories.

MR. ROBERT L. WEST, for the past six years district superintendent of the state of Georgia, for the Southern Bell Telephone Company, has tendered his resignation. Mr. West started telephone work in Richmond,

and when only 19 years old he was manager of the Danville, Va., exchange, later managing the exchanges at Charlotte, Birmingham, and Richmond. During Mr. West's administration in Georgia the system has increased from 13 to 50 exchanges. Mr. West was a valuable man to the Southern Bell, and his severance of business relations by resignation is generally regretted.

MR. R. W. BAILEY, of East St. Louis, has been appointed superintendent of properties for the new East Side Corporation, which has consolidated the East St. Louis and Suburban with the Alton, Granite and St. Louis lines, to succeed Mr. J. F. Porter, in charge of the Alton lines. Mr. Bailey has been given charge of the Alton electric lighting and gas systems and the street railway, the interurban lines operated by the Alton, Granite and St. Louis and the Edwardsville, Alton & St. Louis companies. He will have his office at Alton. Mr. Porter will complete the work of reorganizing the Alton Water Works Company and then go elsewhere to look after the interests of J. G. White & Company.

SAWYER-TOBEY.—At Boston, Mass., on April 28, Mr. Edward Sawyer, president of the Atlantic Insulated Wire & Cable Company, of Stamford, Conn., and New York, was married at Emanuel Church to Miss Leslie Tobey, daughter of Mr. and Mrs. Phineas Sprague Tobey. The wedding was very largely attended, many well-known electrical people being present. The bride was given away by her uncle, Mr. Frank E. Peabody. After the wedding, a reception was given at the home of the aunt of the bride, Mrs. Peabody, on Commonwealth Avenue. Mr. Sawyer is the son of ex-Governor Sawyer, of New Hampshire, and has been connected with the electrical field for some years. The happy pair are now on a prolonged wedding tour, and will upon their return live at Stamford, where the company's factory is situated.

MR. JOHN W. LIEB, JR., past president of the American Institute of Engineers and associate general manager of the New York Edison Compan, sailed for Europe with Mrs. Lieb, on the "Deutschland," for a trip of some ten weeks' duration, including England, France, Germany, Austria, Switzerland and Italy. Mr. Lieb will spend some time in Milan, where he installed and managed for ten years the first European Edison station; and then he and Mrs. Lieb will join in the trips of the British Institution of Electrical Engineers; returning about July 15. This is the first holiday for Mr. Lieb in several years, and in the intervening period he has done a great deal to make American hospitality the admiration of visitors from the other side of the Atlantic, so that a warm welcome awaits him. The trip would be prolonged but for the important work awaiting his return.

MR. LOUIS J. MAGEE, resident director in New York of the Allgemeine Elektricitaets Gessellschaft, was at the Hotel Del Monte, Monterey, Cal., at the time of the great earthquake, but fortunately he and Mrs. Magee escaped injury, although two people in the hotel were killed. He says of the occurence: "My most vivid impression was the feeling that everything was boiling and seething. As I looked out into the fog of the early morning, through the window-screen, the screen seemed to be moving in all directions, and reminded me of a badly adjusted kinetograph. The floor was like the floor of a car on a very rough railway journey. What seemed to be at first low rumbling soon gave place to terrific crashes, and we thought the house was coming down about us. We did not think at the time of the chimneys. In reality the house was oversupplied with chimneys, having about forty-three, of which thirty-one fell in the shock or were so badly injured that they had to be pulled over immediately." Mr. Magee secured instantly with his camera some interesting photographs of the scenes of destruction.

## *Trade Publications.*

FIRST AID.—The P. L. Abbey Company, Kalamazo, Mich., is distributing an illustrated circular calling attention to its emergency accident cabinets as an always ready and reliable first aid to the injured.

ELECTRIC PYROMETER.—W. H. Bristol, New York, has issued a well-prepared description of electric pyrometers, for measuring the temperature of molten metals or of ovens, stacks or annealing furnaces.

ELECTRIC MACHINERY COMPANY, Minneapolis, Minn., has issued Bulletin No. 21 devoted to direct current multipolar generators, for direct connection to high-speed engines. It is a four-page quarto folder and is illustrated in half-tone and in the dimensional diagram.

CEILING FANS.—The Hunter Fan & Motor Company, Fulton, N. Y., has issued a well prepared descriptive catalogue dealing with Tuerk alternating-current ceiling fans. The catalogue will be found unusually interesting by central station managers at this season of the year.

RAILWAY GENERATORS.—The Allis-Chalmers Company, Cincinnati, Ohio, has issued as bulletin No. 1049 a photographic description of numerous installations containing its type of direct-current railway generators and a detailed discussion of the component parts of the generators.

BRICK FOR BOILER SETTINGS is the theme of a neat booklet compiled for free distribution by the Harbison-Walker Refractories Company, Farmers' Bank Building, Pittsburg. It discusses the subject, shows some bricks, and cites the experience of several customers in the electric lighting and traction fields. Our readers should secure a copy.

WATT-HOUR METERS.—Instruction book No. 3,023 of the Fort Wayne Electric Works deals with type K, polyphase induction watt-hour meters. The book gives a general description of the instruments, and contains much valuable information on installing and testing the meters. Diagrams are given of the various connections that may be used in measuring the energy in polyphase circuits.

WIRES AND CABLES.—Catalogue No. 4 of the Indiana Rubber and Insulated Wire Company, Jonesboro, Ind., is intended to present the advantageous features of "Paranite" and "Peerless" rubber-covered wires and cables. It contains also a reprint of that section of the National Electrical Code dealing with fittings, materials and details of construction, and has numerous tables of value to the electrical wireman.

TRANSFORMER FUSE BOXES.—The Fort Wayne Electric Works, Fort Wayne, Ind., has issued as flyer No. 4,504 a brief illustrated description of porcelain fuse boxes for protecting transformers designed for an e.m.f. not exceeding 2,500 volts and a current not more than 30 amperes. The fuse boxes are mounted on the cross arms on the two sides of the transformer. Owing to their shape, they may be substituted for the usual extra insulators.

RUNDLE CHART SYSTEM.—G. M. Gest, the expert subway contractor, has obtained control of the Rundle patented graphic chart system for recording underground and overhead cable data. This system of charts has been adopted by the largest conduit users in the United States. A descriptive article was published sometime ago in the technical papers. Further data regarding this cable chart and its uses can be had by writing to anyone of G. M. Gest's several offices.

THE AMERICAN INSTRUMENT COMPANY has recently issued Bulletin No. 53, which describes a new line of switchboard voltmeters and ammeters that must appeal very strongly to engineers and others who appreciate really high-class workmanship. The instruments embody new features of importance and should be thoroughly investigated by all who have need for such apparatus. A copy of the Bulletin can be obtained from James G. Biddle, general sales agent, 1114 Chestnut St., Philadelphia, Pa.

TIMBER PRESERVING.—The value of preservative treatment for timber which is to be exposed to the elements is well recognized. Railroad ties, poles for telephones, telegraph and trolley wires, and the timber used in piers, wharves and bulkheads are particularly subject to decay unless they are treated beforehand with creosote or other chemicals. The Allis-Chalmers Company builds all the larger kinds of apparatus for this work. Its product includes the retorts in which the timber is treated, cars and other necessary accessories.

"THE ELEVATOR TRUST."—Messrs. A. B. See and W. L. Tyler, owners of the A. B. See Electric Elevator Co., 220 Broadway, New York City, have issued a circular attacking the Otis Elevator Company in connection with the suit of the Government against the "elevator trust" for violation of the Sherman anti-trust law. The circular quotes the Washington dispatch of March 7 giving news of the suit, and then comment is added by the gentlemen above named discussing the subject very freely and acrimoniously, and making certain allegations.

MULTIPLE-VOLTAGE SYSTEM.—The Allis-Chalmers Company, Cincinnati, Ohio, uses bulletin No. 1044 to present a well-prepared description of the multiple-voltage system of control for variable-speed, direct-current motors. In the three-wire system two balancers are used giving 90, 160 and 250 volts as desired. In the four-wire system there are used three direct-connected balancers wound for 60, 80 and 110 volts, respectively, so there are obtained 60, 80, 110, 140, 190 or 250 volts as desired. Descriptions are given of the controllers and of the motor-generators used in the balancer sets.

PICTURE LIGHTING is the title of a dainty pamphlet issued by I. P. Frink, 551 Pearl Street, New York City, dealing with the famous Frink reflectors as applied to the illumination of art galleries. It is not an exposition of the features of merit in these reflectors, but gives views of three or four celebrated galleries where the reflectors are to be found with a few pithy observations on the subject. Then follow several closely printed pages giving a list of private and public collections where art lovers are enabled to enjoy the pictures and statuary to the fullest degree because they are properly illuminated.

VOLTAX.—The new insulating material of the Electric Cable Company, of Bridgeport, Conn., is the theme of a most artistic little brochure prepared for the company by Bruce & Banning, the publicity experts. It is a 16mo in boards with red cloth backing, and roxburghe label on the front cover. The one illustration is a pretty tint view of the works. The pamphlet is no mere pretty toy, but it contains an admirable digest of data in regard to tests, uses, etc., of the insulation, all printed in good bold type. No engineer who gets this will throw it aside carelessly, but will first admire and then peruse diligently.

THE STURTEVANT ECONOMIZER is the title of catalogue No. 130 just issued by the B. F. Sturtevant Co., of Boston, Mass., in its Engineering Series. This finely illustrated pamphlet of 48 pages, 6½x9 inches, is suggestive of the rapid progress made in the installation of this important factor in economic steam generation. It comprises a detailed description of the economizer, with statements of its advantages, instructions regarding installation, operation and repairs, a discussion of mechanical draft as an adjunct to the economizer and a series of valuable tables relating to the flow of air, efficiency of fuels, etc.

STEAM ENGINES.—A neat little catalogue recently received from the Ball Engine Company, Erie, Pa., gives a brief outline of new engine designs including side-crank, single-cylinder, belted and direct-connected engines, tandem and cross-compound, side-crank engine, and both horizontal and vertical simple and compound Corliss engines with improved valve motion. Each of these types is represented by a full-page illus-

tration. Catalogue O, of the same company, gives a more elaborate discussion of the design, features and operating characteristics of the standard engines. It is interesting to observe that with the exception of the single-cylinder, belted type engine each engine illustrated is shown driving an electric generator. A prominent feature of these engines is found in the Robb-Armstrong-Sweet governor, to the detailed description of which the Ball Engine Company had devoted a special pamphlet.

## News of the Trade.

THE STAR ELECTRIC COMPANY, of Youngstown, has leased temporary quarters in Warren, where it will manufacture storage batteries.

THE AMERICAN VITRIFIED CONDUIT COMPANY is moving its offices to the Fuller Building, Fifth Avenue and Twenty-third Street, New York.

THE ELECTRIC STORAGE BATTERY COMPANY, of Philadelphia, Pa., announces the opening of a branch office in Pittsburg, located in the Frick building annex.

H. B. CAMP COMPANY, vitrified clay conduit manufacturer, is moving its New York offices to the Flat Iron Building, Broadway, Fifth Avenue and Twenty-third Street, New York.

THE DEFOREST WIRELESS STATION will establish a new station on the twelfth floor of the National Bank of Commerce at Norfolk, Va., and will handle messages to a distance of about 1,000 miles.

THE NEW ENGLAND ELECTRIC COMPANY, manufacturer of electrical appliances, making a specialty of porcelain goods, has moved its plant from Denver, Col., to Trenton, N. J. The company will maintain a branch in Denver.

THE WISCONSIN BRAKE & ELECTRIC COMPANY, successor to the National Electric Company, notifies us that its general sales offices will be located hereafter at No. 519 First National Bank Bldg., Chicago, instead of in Milwaukee.

ANDERSON LINE MATERIAL.—The Universal Railway Supply Company, of Baltimore, Md., has been appointed sales agent for Anderson line material in Maryland, Delaware, District of Columbia, Virginia and North Carolina, by the Albert & J. M. Anderson Mfg. Co., of Boston.

THE ENGINEERING SPECIALTY COMPANY, of Meriden, Conn., has acquired the property of the Max-Riddell Hardware Manufacturing Company, in Stamford, Conn., and will construct a plant on the site. The company manufacturers motors, generators, sparking dynamos and magnetos, and dynamotors for telephone and annunciator systems.

GREGORY ELECTRIC CO.—The Gregory Electric Co. has removed to very largely increased quarters at 16th and Lincoln Streets, Chicago, the general offices, warehouse and works all being now at this new location. This was made necessary by the large growth in this company's business, and the concern is now equipped to handle the heaviest apparatus advantageously.

WHITE & MIDDLETON, of Baltimore, are constructing dynamos for submarine boats for Russia and Germany. They will install in the boats gasoline marine engines, and while the boats run at the surface of the water, the engines will be used to store electricity from the dynamos. While running under the surface, the boats will be driven by the electric motors fed from the batteries.

THE BOSTON INSULATED WIRE & CABLE COMPANY is the new name for the business formerly known as the Clark Insulation Company, Boston, Mass. The business of this company has grown so rapidly within the last year that a change of location has been found necessary, and negotiations are under way for a most modern and complete factory to take care of the rapidly increasing business.

OIL ENGINES.—Burk Bros. & Co., merchants of Kirksville, Mo., are installing a refrigerating machine and a 28-hp "Hornsby-Akroyd" oil engine to drive same. Both the oil engine and refrigerating machine are supplied by the De La Vergne Machine Co. Mr. John B. Eyres, Paterson, N. J., is installing a refrigerating machine, also one 7-hp and one 13-hp "Hornsby-Akroyd." The 13-hp oil engine is to drive the refrigerating machine. Both the refrigerating machine and oil engines are supplied by the De La Vergne Machine Company.

VIELE, COOPER AND BLACKWELL is a new firm of consulting electrical and mechanical engineers, with offices at 49 Wall Street, New York City. The firm comprises Messrs. F. O. Blackwell, Hugh L. Cooper, M. A. Viele and H. W. Buck, all of whom are already well known in the American engineering field. They have already some very large projects in hand, and will specialize as to transmission and hydro-electric enterprises—in connection with which work their individual names have already become associated closely, as to successful plants now in operation in the United States, Mexico and elsewhere.

"BRILLIANT" LAMPS.—Mr. E. J. Kulas, the secretary of the Brilliant Electric Co., of Cleveland, O., has just returned from an extensive trip through the Southern States and Mexico. The object of the trip was largely the appointment of agencies throughout that section of the country. Mr. Kulas made satisfactory arrangements with some thirty supply dealers to carry Brilliant lamps in stock. These agencies, together with the large number previously arranged for, makes it possible to purchase these lamps in any part of the country and have orders promptly attended to.

STURTEVANT MOTORS.—Although standard Sturtevant motors are built for independent service, a specialty is made of attaching them to fans which demand special combinations of speed and power. These motors are built in a line of bi-polar, four-pole and eight-pole types, dependant upon size and requirements. The enclosed type prevails for fan propulsion where there is considerable dust. They range in output up to 125 horse-power. The rigid specifications of the U. S. Navy Department, under which many fan motors have been constructed, have established an exceptionally high standard which is maintained in all work.

THE AMERICAN CONDUIT COMPANY announces the removal on May 1, 1906, of its Chicago offices to more central and more commodious quarters in the Marquette Building, where Mr. A. L. Waterbury, general manager of the sales department, will be glad, as in the past, to receive the friends and patrons of the company, and where all inquiries by mail or otherwise will receive prompt and careful attention. The increase in the business of the American Conduit Company is decidedly gratifying, and gives satisfactory evidence, both by the volumne of business and by the class of customers being served, that the merits of bituminized fiber conduit as an underground conduit have had practical demonstration and are being accepted with rapidly increasing favor.

THE GEO. H. GIBSON CO. advertising engineers, Park Row Building, New York City, which conducts the advertising of a number of the leading machinery manufacturers, has recently taken up the subject of disposing of inventions. This concern acts as commission agents in the selling of inventions and uses personal representation and correspondence in bringing about a sale. The three members of the organization are engineers with practical experience in civil, mechanical, mining and electrical work and have made, patented and sold inventions of their own. Their client's inventions are presented in a bulletin, entitled "Engineering and Manufacturing," which has just come to hand and which contains, in addition to descriptions of several new inventions, articles of interest to manufacturers and inventors.

OIL FILTERS.—Among those who have purchased White Star oil filters recently are: Sears, Roebuck Co., Chicago; Mandel Bros., Chicago; American Steel & Wire Co., Waukegan, Ill.; Youngstown Sheet & Tube Co., Youngstown, O.; Boston Elevated Railway Co., Boston, Mass.; Merchants' Ice & Coal Co., St. Louis, Mo.; City Electric Light Plant, Easton, Pa.; Utica Industrial Co., Rome, N. Y.; Northern Mfg. Co., Detroit, Mich.; Mutual Light & Water Co., Brunswick, Ga.; Indiana County Gas Co., Indiana, Pa.; Elk Lick Library Co., Hambleton, W. Va.; New England Cotton Yarn Co., New Bedford, Mass. One of the chief features of the White Star oil filter is the ease with which it may be taken apart and cleaned without interrupting the operation of purifying dirty oil. This and its other many advantages are shown in booklets which the Pittsburgh Gauge & Supply Co., Pittsburg, Pa., will be pleased to mail all engineers.

## DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

American Electro-Therapeutic Association. Secretary, Dr. C. E. Skinner, New Haven, Conn.

American Electrochemical Society. Secretary, S. S. Sadtler, 59 S. 10th St., Philadelphia. Next meeting Ithaca, N. Y., May, 1906.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 95 Liberty St., New York. Meetings, fourth Friday of each month.

American Railway, Mechanical & Electrical Association. Secretary, Walter Mower, 12 Woodward Avenue, Detroit, Mich.

American Society of Civil Engineers. Secretary, Chas. W. Hunt, 220 West 57th St., New York.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st St., New York. Next meeting, Chattanooga, Tenn., May 1-4, 1906.

American Society of Municipal Improvements. Secretary, G. W. Tillson, Municipal Building, Brooklyn, N. Y. Next meeting, Birmingham, Ala., Oct. 2-5, 1906.

American Street & Interurban Railway Association. Secretary, B. V. Swenson, 60 Wall St., New York. Next convention, Columbus, Ohio, Oct. 15-20, 1906.

Association of Edison Illuminating Companies. Secretary, Geo. R. Stetson, New Bedford, Mass. Next meeting, September, 1906.

Association of Railway Telegraph Superintendents. Secretary, P. W. Drew, Milwaukee, Wis. Next meeting, Denver, Col., May, 1906.

Association of Electric Lighting Engineers of New England. Secretary, C. R. Brown, 516 Atlantic Ave., Boston, Mass. Annual meetings held in Boston on third Wednesday in March.

California Independent Telephone Association. Secretary, P. T. Whittier, Spencer, Cal.

Canadian Electrical Association. Secretary, C. H. Mortimer, Toronto, Ont. Next meeting, Niagara Falls, Ont., 1906.

Colorado Electric Light, Power & Railway Association. Secretary, George B. Tripp, Colorado Springs, Col.

Connecticut State Street Railway Association. Secretary, E. W. Poole, Bridgeport, Conn. Annual meeting in November, 1906.

Engine Builders' Association of the United States. Secretary, J. I. Lyle, 39 Cortlandt St., New York.

Electric Club of Cleveland. Secretary, Geo. L. Crosby, 1200 Schofield Building, Cleveland, Ohio.

Electrical Contractors' Association of New York State. Secretary, F. Fish, 123 Mill St., Rochester, N. Y. Next meeting, New York City, June 19, 1906.

Electric Contractors' Association of State of Missouri. Secretary, Chas. J. Sutter, 1220 Pine St., St. Louis, Mo.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary-Treasurer, Geo. H. Erich, 461 Monadnock Block, Chicago. Next annual meeting, Chicago, January, 1907.

ELECTRICAL TRADES ASSOCIATION OF CHICAGO. Secretary, Frederic P. Vose, Marquette Building, Chicago. Next meeting, Chicago, Nov. 1, 1906.

ELECTRICAL TRADES ASSOCIATION OF PHILADELPHIA. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia, Pa. Meetings second and fourth Thursdays each month.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, Wm. R. Staveley, Royal Insurance Building, Montreal, Can. Next annual meeting, January 14, 1907.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliot, Claus Spreckels Building, San Francisco, Cal. Monthly meetings, San Francisco, first Thursday of each month.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall Street, New York. Board of Directors meets second Friday of each month.

EMPIRE STATE GAS AND ELECTRICAL ASSOCIATION. Secretary, T. R. Beal, Poughkeepsie, N. Y. Annual meeting, October, 1906.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, La Salle, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, Dr. Arthur H. Elliot, 4 Irving Place, New York. Meetings in New York second Friday of each month.

INDEPENDENT TELEPHONE ASSOCIATION OF SOUTHERN INDIANA. Secretary, E. W. Landgrebe, Huntingburg, Ind.

INDIANA ELECTRIC RAILWAY ASSOCIATION. Secretary, P. H. White, Indianapolis, Ind. Monthly meetings, second Thursday of each month.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, New Haven, Conn., Aug. 16-18, 1906.

IOWA STREET AND INTERURBAN ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Ia.

IOWA ELECTRICAL ASSOCIATION. Secretary, George S. Carson, Iowa City, Ia.

IOWA TELEPHONE ASSOCIATION. Secretary, C. C. Deering, Boone, Ia.

KANSAS GAS, WATER & ELECTRIC LIGHT ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Lawrence, Kan., Oct., 1906.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, James Maret, Mount Vernon, Ky. Regular meeting, second Tuesday in October each year.

MAINE STREET RAILWAY ASSOCIATION. Secretary, E. A. Newman, 471 Congress St., Portland, Me.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

MICHIGAN ELECTRIC ASSOCIATION. Secretary, A. C. Marshall, Port Huron, Mich. Next meeting, Oct. 16, 1906.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, James F. Barnett.

NATIONAL ARM, PIN & BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Fred P. Vose, 1343 Marquette Building, Chicago. Next meeting, June 14, 1906.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 94 Genesee Street, Utica, N. Y. Next meeting, Cleveland, O., July 18, 1906.

NATIONAL-INTERSTATE TELEPHONE ASSOCIATION. Secretary, A. L. Tetu, Nashville, Tenn. Next meeting, Chicago, June 26, 27 and 28, 1906.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, W. C. L. Eglin, Philadelphia, Pa. Twenty-ninth Convention, Atlantic City, N. J., June 5-8, 1906.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State St., Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 114 Liberty Street, New York.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, T. S. Lane, 536 Ellicott Square, Buffalo, N. Y. Next meeting, Elmira, N. Y., June, 1906.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary, B. C. Adams, Madison, Wis.

OHIO ELECTRIC LIGHT ASSOCIATION, Secretary, D. L. Gaskill, Greenville, O. Next meeting, Put-in-Bay Island, Aug. 21-23, 1906.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Portsmouth, O.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, F. W. Bullard, Cleveland, O. Next meeting, Pittsburg, Pa., May 17, 1906.

OHIO STREET RAILWAY ASSOCIATION. Secretary, Chas. Currie, Akron, O.

OLD TIME TELEGRAPHERS AND HISTORICAL ASSOCIATION. Secretary, John Brant, 195 Broadway, New York. Next meeting, Washington, D. C., Oct. 9, 10 and 11, 1906.

PACIFIC COAST ELECTRICAL TRANSMISSION ASSOCIATION. Secretary, Samuel G. Reed, Portland, Ore. Next annual meeting, June 19, 1906.

PENNSYLVANIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, H. E. Bradley, 135 South Second Street, Philadelphia, Pa.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings second Saturday of each month.

SOUTH DAKOTA TELEPHONE ASSOCIATION. Secretary, H. B. Hartwell, Irene, S. D.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, Frank J. Duffy, Beaumont, Tex. Next meeting, Galveston, May 16, 17 and 18, 1906.

STREET RAILWAY ACCOUNTANTS' ASSOCIATION OF AMERICA. Secretary, E. M. White, Box 345, Hartford, Conn.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, C. B. Fairchield, Jr., 114 Liberty St., New York.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION. Secretary Electrical Committee, C. M. Goddard, 55 Kilby Street, Boston, Mass.

VERMONT AND NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, G. W. Buzzell, St. Johnsbury, Vt. Next meeting, July 10 and 11, 1906.

VERMONT ELECTRICAL ASSOCIATION. Secretary, C. C. Wells, Middlebury Electric Light Company, Middlebury, Vt. Next meeting, St. Johnsbury, Vt., September, 1906.

WESTERN SOCIETY OF ENGINEERS, Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Wednesday of each month, except January, July and August. Annual meeting first Tuesday after Jan. 1, each year.

# Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED APRIL 24. 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

818,424. SAFETY DEVICE FOR ALTERNATING-CURRENT DISTRIBUTION; George N. Eastman, Chicago, Ill. App. filed Sept. 17, 1904. An automatic safety device for alternating currents consisting of a plurality of circuit-conductors arranged on different sides of the system and their electromotive forces differing from each other in phases; a group of independent windings insulated from each other, one for each of the circuit-conductors, arranged in close proximity and bearing the same inductive relationship to each other, whereby the inductance is neutralized when the vectorial sum of the currents in the circuit-conductors is zero; and an extra coil for controlling an electro-sensitive device, said extra coil being in position to be inductively energized by any one of the first-mentioned coils.

818,449. PORTABLE ELECTRIC LIGHT; Conrad Hubert, New York, N. Y. App. filed May 19, 1905. A miniature pocket lamp including a pair of dry batteries and a lamp bulb disposed therebetween. Has a switch which can be slid sidewise so as to be locked in one position and avoid exhausting the battery by accidental displacement.

818,477. PRINTING TELEGRAPH; Robert J. Sheehy, New York, N. Y. App. filed May 22, 1903. A printing telegraph having the usual sunflower wheel and keys which complete electrical circuits to various segments thereof. The invention lies particularly in the means for disengaging the trailer from the sunflower wheel when receiving.

818,480. BINDING POST; Clyde Slusser, Charleston, W. Va. App. filed Mar. 17, 1905. A spring binding post constructed entirely of malleable iron and having prongs at one end which are adapted to be bent up so as to conveniently engage the base of any article to which the binding post is to be attached.

818,495. SYSTEM OF OPERATING RAILROAD SWITCHES; Aldred K. Warren, New York, N. Y. App. filed June 24, 1905. A central station instrument for operating track switches. Includes a plurality of keys which directly work the switch levers in an oil bath. At the same time certain magnets move switches on a miniature track in front of the operator so as to show the condition of the actual track.

818,515. ELECTRIC SIGNAL SYSTEM; Victor W. Bergenthal, Chicago, Ill. App. filed July 21, 1904. The usual trolley wire has contact plates adjacent thereto which are engaged by the trolley wheel under certain circumstances. The circuit closed thereby operates relay magnets which control the lamp circuits.

818,527. TELEPHONE TRUNKING SYSTEM; William W. Dean, Chicago, Ill. App. filed July 14, 1902. The combination with a trunk-line adapted to connect with a calling telephone-line at its outgoing end and with a called telephone-line at its incoming end, a signal at the incoming end of the trunk, a trunk-relay at said end actuated by current over the trunk when connection is established at the outgoing end for preventing the operation of said signal, means actuated when the called subscriber responds for entirely depriving said relay of operating-current, and means whereby said relay still remains in operated position although deprived of operating-current through any of its windings and prevents the actuation of said signal during conversation, substantially as described.

818,534. APPARATUS FOR INDICATING THE CHARACTER OF ELECTRICAL EFFLUVIA; Leon Gerard, Brussels, Belgium. App. filed June 14, 1905. The rays from a vacuum tube are directed through a small perforation in a lead screen and subsequently through a prism against a continuously moving photographic film. In this way the character of the rays is investigated.

818,540. TELEPHONE-EXCHANGE SYSTEM; Edmund Land, Grand Rapids, Mich. App. filed Mar. 20, 1905. In a telephone system, the combination of a substation-telephone, a central office, a trunk-selecting switch in said central office, a line connecting said substation-telephone with said trunk-connecting switch, speech-transmitting elements forming a part of said substation-telephone and adapted to receive electrical energy for speech transmission from said connecting telephone-line, a source of electrical potential in said central office and connected to said line, a trunk in said central office, a visual signal, and a circuit including said source of potential, said relay, said line, said speech-transmitting elements, a conductor in said trunk and said visual signal, substantially as described.

818,561. SWITCH; Edward P. Robbins, Mansfield, O. App. filed Oct. 20, 1905. An electrically operated switch having a pair of shoes adjacent the usual trolley rail which are engaged by separate trolley pole connections when desired. These are in circuit with a pair of solenoid coils which move an armature directly connected to the switch point.

818,589. ELECTRIC HAMMER; William F. Wegner, New York, N. Y. App. filed Sept. 9, 1905. Details of an electric hammer having a solenoid with two coils, and an armature reciprocating therebetween. The armature impinges against the tool at each reciprocation.

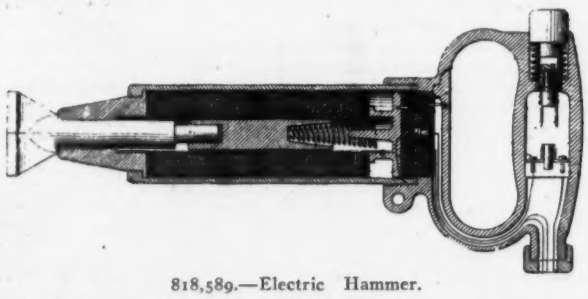
818,614. ELECTRICAL SWITCH AND CUT-OUT; Charles M. Dorman, Reginald A. Smith and Herbert G. Baggs, Salford, England. App. filed Mar. 28, 1905. A form of magnetic circuit-breaker having two separate circuit breaking blades or levers which must be closed and opened in a predetermined order by reason of certain intermediate lever connections.

818,631. TROLLEY WIRE SUPPORT; Ames H. Land and Uriah Gulnick, Newark, N. J. App. filed May 4, 1905. A form of support or hanger for trolley wires having laterally projecting flanges and central lips depending therefrom. The lips are arranged to be bent inward so as to embrace the usual trolley wire.

818,673. SIGNAL-BELL FOR TELEPHONE SYSTEMS; Charles E. Egan, Columbus, O. App. filed Feb. 27, 1903. In a signaling apparatus for telephone instruments, a combined ringer and condenser comprising a frame, a yoke of magnetic material, a pair of elongated cores extending from the said yoke parallel to each other, an insulated wire winding or bobbin upon one core, in approximately cylindrical shape, insulated conducting-sheets rolled and compressed upon the other core to form a condenser also approximately cylindrical in shape and of substantially the same diameter as the said bobbin, a pivoted armature mechanically held in proximity to the free ends of the parallel cores and disconnected for any operative electrical function from the other parts, a clapper-rod and clapper adapted to be actuated through said armature, sounding means adjacent to said clapper, and circuit connections permanently including said coil or bobbin and said condenser in series so that all current through the coil or bobbin must pass into said condenser, substantially as described.

818,675. TELEPHONE-SIGNAL; Andreas Vilhelm (called Wilhelm) R. Fechtenburg, New York, N. Y. App. filed Dec. 8, 1904. In a telephone system, the combination of a central office and a plurality of subscribers' stations connected therewith with means whereby interconnected subscribers can send call-signals to each other while the central office cannot call either of the connected subscribers.

818,686. MEANS FOR AUTOMATICALLY CONTROLLING THE OPERATION OF BEER OR OTHER PUMPS AND SIMILAR DEVICES; Alfred C. Griscom, Newark, N. J. App. filed July 6, 1905. A device for insuring a uniform flow of beer from the tanks in the cellar of a saloon to the beer plugs. For this purpose an air pressure reservoir is employed in which a uniform pressure is maintained by a diaphragm motor pump similar to the ordinary motor pump of an electric air brake system.



818,589.—Electric Hammer.

818,698. TELEPHONE; Samuel P. Levenberg, New York, N. Y. App. filed Jan. 16, 1905. In telephony, in combination, transmitting mechanism, a member mounted adjacent said transmitting mechanism and provided with an opening, a mouthpiece adapted to fit said opening and provided with a flange resting against said member and an adjustable collar adapted to hold said flange against said member.

818,715. MEANS FOR TRANSMITTING POWER BY ELECTRIC CURRENTS; William Stanley, Great Barrington, Mass. App. filed July 19, 1904. In a system of power transmission, the combination of means for producing a plurality of sets of currents of differing frequencies, a motor having a rotor and a stator each energized by one of said sets of frequency-differing currents so as to have rotating magnetic fields impressed upon them respectively and means for changing the relative direction of rotation of said fields.

818,744. SIGNAL APPARATUS; Clarence W. Coleman, Westfield, N. J. App. filed Feb. 6, 1905. A mechanism for operating a semaphore arm to any one of three positions. Includes an electric motor and gear connections therefrom to the main rod of the semaphore arm. A special lever and switch arrangement is used so as to insure the required movement of the semaphore arm under different conditions.

818,750. CLUSTER LAMP-SOCKET; John H. Dale, New York, N. Y. App. filed Feb. 4, 1905. Relates to a construction of mounting the threaded shells upon the contact plate of a lamp socket in a flexible manner, so that when the cluster is assembled the shells can be swung out of their normal position to admit them easily into the various openings of the cap.

818,767. TELEPHONIC DEVICE; Isidor Kitsee, Philadelphia, Pa. App. filed June 15, 1903. In telephony a connecting-cord consisting of the cord proper, two plugs electrically connected to said cord, each of said plugs embracing an electromagnet and a source of current, said source of current connected in multiple arc as to the two conductors of said cord.

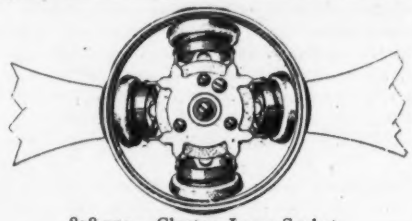
818,768. ELECTRICAL CONTROLLER FOR ELECTRIC VEHICLES; Karsten Knudsen, Chicago, Ill. App. filed Jan. 13, 1902. Details of a controller system in which the controller segments are adapted to have an abrupt movement from point to point regardless of the movement of the controller arm. For this purpose a special arrangement of cam and detent rollers is arranged within the controller box.

818,773. SWITCH THROWING DEVICE; John H. Meyer, New Kensington, Pa. App. filed Dec. 21, 1905. Device for operating a track switch involving a pair of arms or tappets projecting from the roadbed and mechanically connected to the switch point. The movement of the switch point closes different lamp circuits.

818,791. PLUG SOCKET FOR ELECTRIC LAMPS, ETC.; Frank J. Russell, New York, N. Y. App. filed July 12, 1905. Details of construction of a plug socket having a metallic casing and certain internal parts of porcelain.

818,793. LOCK-OUT TELEPHONE SYSTEM; Louis A. Schmidt, Chicago, Ill. App. filed Aug. 21, 1905. In a telephone system, a central station, parallel conductors therefrom, a plurality of normally open telephone sets bridged between said conductors, and in association with each such set means for controlling the continuity of a conductor therebeyond comprising a relay having its normally open armature arranged to control the continuity of the line, and having a winding in shunt between the said conductor and the bridge connections, whereby current flows therethrough in one direction to cause the attraction of the armature, and opening of the line therebeyond when the bridge is closed at such station, and in the other direction to leave the armature unattracted, and the line closed when a circuit is completed at a point more remote from the central station than such station referred to.

818,795. RAILWAY SIGNALING DEVICE; Charles T. Smith, Lebanon, Pa. App. filed Mar. 30, 1905. A semaphore system for trolley roads having a switch box at each turn-out with a lever which is moved by



818,750.—Cluster Lamp-Socket.

the ear contactor into one of two extreme positions. At each turn-out there is a solenoid magnet with two armatures which establish certain lamp circuits according to the position of the operatng arms.

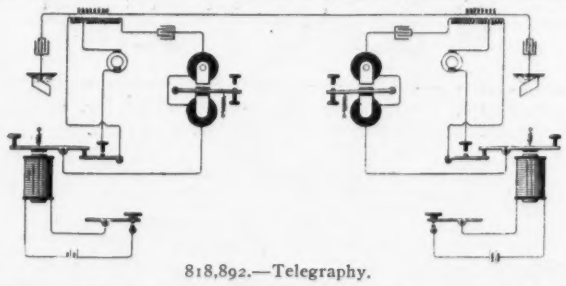
818,855. RAILWAY SIGNAL SYSTEM; Alfred L. Ruthven, Topeka, Kan. App. filed Sept. 1, 1905. A railroad signal system designed to notify an engineer of the presence of another train on the same track, and whether the train is moving in the same or in the opposite direction. Special trolley circuits are provided which include alarm devices on the separate cabs, and certain tappets along the roadbed are also operative to indicate the direction of the respective trains.

818,892. TELEGRAPHY; Sterns F. Jones, New York, N. Y. App. filed Nov. 21, 1905. Relates to that form of telegraphy in which short and rapid alternations of current are divided into groups of varying length under the control of a key or circuit changer. The patentee aims to strengthen the transmitted impulses and strengthen the received impulses without changing the electromotive force or the strength of current of the alternating-current generator. For this purpose special local circuits are arranged including transformers and condensers.

818,897. TELEPHONE SYSTEM; Ray H. Hamson, Elyria, O. App. filed June 25, 1904. In a telephone-exchange system, a central station and a subscriber's station with a line-circuit interconnecting them, a source of current for the line at the central station, a telephone receiver and transmitter at the subscriber's station and a Wheatstone bridge circuit connection for the receiver, having its alternate arms containing inductive resistance, those intermediate thereof non-inductive resistance, the receiver in the bridge-wire, the extremities of the bridge to line, and the transmitter in series with the line and bridge, whereby battery-current may flow through the transmitter in considerable volume without producing any difference of potential across the terminals of the receiver, while voice-currents produced in the line will be forced practically all through the bridge-wire and the receiver.

818,918. PROCESS OF MANUFACTURING IRON AND ITS ALLOYS; Marcus Ruthenburg, Lockport, N. Y. App. filed Nov. 28, 1903. The continuous process of reducing ore to the metallic state, which consists in fritting comminuted particles of ore in coherent porous lumps, collecting the lumps in a confined heated atmosphere, then before said lumps have fallen below a reducing temperature, subjecting them to the action of reducing media in said confined heated atmosphere and reducing them without fusing them, and then increasing the temperature of said lumps, until the reduced metal is melted, substantially as set forth.

818,947. SHOE CONTACT; George H. Fretts, Springfield, Mass. App. filed May 13, 1905. An insulated shoe or section for a trolley wire suitable for the purposes of track switches and the like. Has metallic



818,892.—Telegraphy.

plates secured to the trolley wire by bolts. The metallic plates have holes beneath the bolts so that the latter may drop to the ground in case they become loosened and not interfere with the passage of the trolley wheels.

818,982. EXTENSION-ARM TELEPHONE; Thomas J. Skelley, Collinwood, O. App. filed Apr. 25, 1904. In an extension-arm telephone, the combination of a base, an extensible arm pivoted thereto and carrying at its outermost end an upwardly-projecting pivot-pin, and a tubular telephone pedestal having at its lower end a member which substantially closes the tube and is provided with a socket engaging such pivot-pin.

819,009. ELECTRIC INCANDESCENT LAMP; Otto Feuerlein, Charlottenburg, Germany. App. filed June 14, 1904. An electric incandescent lamp comprising a continuous metallic filament, and insulating means to support the same in a plurality of substantially straight lengths or sections, each length or section being supported by said insulating means, at both its ends.

819,028. METHOD OF TRANSMITTING POWER BY ELECTRIC CURRENTS; William Stanley, Great Barrington, Mass. App. filed July 19, 1904. The method of transmitting power at varying speeds by alternating currents which consists in impressing upon the rotor element of a motor a field due to alternate currents of one frequency, and impressing upon the stator element a field due to alternating currents of a different frequency and varying the relative direction of rotation of the impressed fields.